PROCEEDINGS OF THE CALIFORNIA ACADEMY OF SCIENCES
Fourth Series

Volume 57, No. 7, pp. 247–355, 19 figs., Appendix: 5 tables, List. April 18, 2006

Vascular Flora of Isla del Coco, Costa Rica

Jennifer L. Trusty[1,2], Herbert C. Kesler[2,3], and German Haug Delgado[4]

[1] *Department of Biological Sciences, University Park, Florida International University, Miami, FL 33199, U.S.A., and* [2] *Fairchild Tropical Botanic Garden, 11935 Old Cutler Road, Miami, FL 33156, U.S.A. (Current address: Center for Forest Sustainability, 602 Duncan Drive, Auburn University, Auburn, AL 36849, U.S.A. [correspondence]);* [3] *Current address: Department of Biological Sciences, 106 Funchess Hall, Auburn University, Auburn, AL 36849, U.S.A.;* [4] *Parque Nacional Isla del Coco, Apartado 11383-1000, San José, Costa Rica.*

Isla del Coco (Cocos Island) is a small volcanic island located 500 km off the Pacific coast of Costa Rica. The flora of this remote island had been studied sporadically, and historical plant collections are scattered in herbaria throughout Europe, Central and North America. Since the island's discovery in 1526, no fewer than fifteen major historical collecting trips have been made to it. The resulting collections have provided the basis of our floristic knowledge of the island. For the current study, three collecting trips, in addition to herbarium research, were undertaken in order to assess the floristic diversity of the island. Two hundred and sixty-three plant species were identified of which 37 are endemic to Isla del Coco. Furthermore, as a result of this study, we now report an addition of 51 species as new to the island.

Seven vegetation types are identified on the island: bayshore, coastal cliff, riparian, low elevation humid forest, high elevation cloud forest, landslide and islet. The island is unique among OCEANIC islands WORLDWIDE in that it receives nearly 7 m of rain each year. This rainfall supports the island's high fern diversity. Forty-two percent of the native vascular plants are pteridophytes and 50% of the endemic species are ferns. This high number of endemic pteridophytes is not known on any other oceanic island. Like many islands, Isla del Coco has been impacted by contact with humans. In this study, we consider 71 species (27%) as introduced by humans to the island. In addition, five potentially invasive plant species are identified. Isla del Coco is both a national park and a UNESCO World Heritage Site. This current level of official protection can provide a legal framework for the future preservation of its unique plant biodiversity.

Resumen

La Isla del Coco es una pequeña isla oceánica del Océano Pacífico situada a unos 500 km de Costa Rica. La flora de esta isla remota ha sido estudiada de forma muy esporádica y sus colecciones históricas se encuentran dispersas en varios herbarios de Europa, Centro- y Norte-América. Desde el descubrimiento de esta isla, en el año de 1526, la misma ha sido el objetivo de quince expediciones botánicas de importancia. Las colecciones de estas expediciones han proporcionado la base para su conocimiento florístico. En el trabajo que se presenta hacemos una investigación de la diversidad florística de la Isla del Coco. Esta investigación se basa en material recientemente recolectado por nosotros en tres expediciones botánicas y en la revisión de material depositado en varios herbarios. La Isla del Coco contiene 263 especies vegetales, de las cuales 37 son endémicas. Se dan 51 especies como nuevas registras para la flora

de la isla. Se identifican siete tipos diferente de vegetación: litoral costera, litoral rupícula, higrófila, bosque húmedo a baja altitud, bosque nubaldo a gran altitud, derrubios, e islotes. La cantidad de lluvia que recibe la isla anualmente llega a los 7 m. Esta alta e inusual precipitación favorece una gran diversidad en pteridófitos. Cuarenta y dos por ciento de la flora vascular nativa de Isla del Coco está formada por helechos y el 50% de las especies endémicas de esta isla pertenecen a este grupo de plantas. Esta alta proporción de helechos no es conocida en ninguna otra isla oceánica. Al igual que otras islas, la Isla del Coco ha recibido el impacto de la intervención humana. En este estudio se considera que 71 especies (27% de la flora) son el resultado de introducciones por humanos. Consideramos que cinco de estas especies tienen un gran peligro de convertirse en especies invasoras y se recomienda su erradicación de la isla. La Isla de Coco tiene categoría de Parque Nacional y de Patrimonio Mundial de la Humanidad UNESCO. Este nivel de protección oficial puede proporcionar el marco legal para la conservación futura de la biodiversidad vegetal única de esta isla.

Introduction

Location (Fig. 1): Isla del Coco, also known as Cocos Island, is a small, 24 km^2 volcanic island located at 5°32′57″N latitude and 86°59′17″W longitude in the Pacific Ocean. The island is approximately 500 km (300 miles) west of Costa Rica and 680 km (350 miles) northeast of the Galápagos Islands. The highest point on the island is 630 m (2275 ft) at Cerro Iglesias. Although the island was claimed by Costa Rica in 1869, it remains nearly uninhabited to this day. The name Isla del Coco arose as a misnomer from the original map in 1542 where the island was called "Ysle de Coques" or Seed Island (Anonymous 1920).

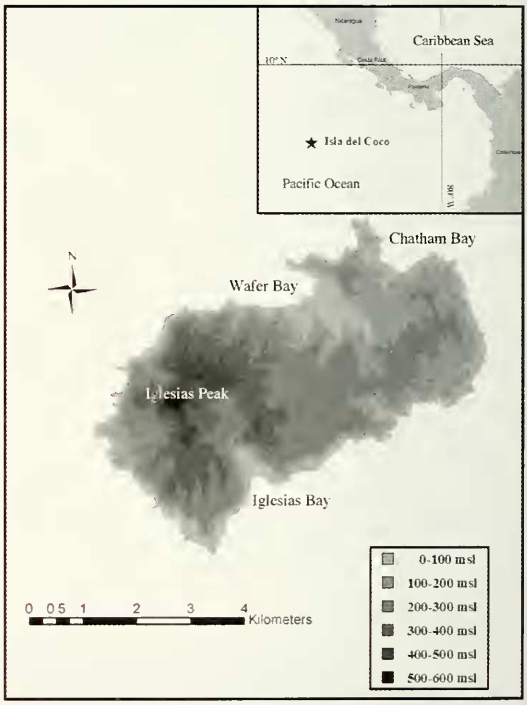

Figure 1. Isla del Coco. Map prepared by author.

National and international conservation status: Isla del Coco was designated as a Costa Rican National Park by Executive Decree in 1978. In 1991 the Park's limits were extended to include the marine ecosystems up to a distance of 15 km around the island. At this time, the entire park was declared a zone of absolute protection, and no resources can be extracted. In 1995, both the marine and terrestrial regions were designated as National Conservation Areas, and in 1997 Isla del Coco was inscribed on the World Natural Heritage List by UNESCO. In addition, in 1998 Cocos Island was designated as a Wetland of International Importance by the Ramsar Convention.

The island is world-renowned for its unique marine life and heralded for its location as a marine bird breeding ground. Unfortunately, little has been mentioned about the floristic composition and diversity of Isla del Coco. This work hopes to bring attention to Isla del Coco as one of the true botanical treasures of Costa Rica.

MAP AND LOCATIONS: The names of the locations used in this paper can be found on the map shown in Figure 2. The location of French Point, listed in the collection information for *Cyperus tenuis*, was not found; we believe it corresponds to Cape Dampier.

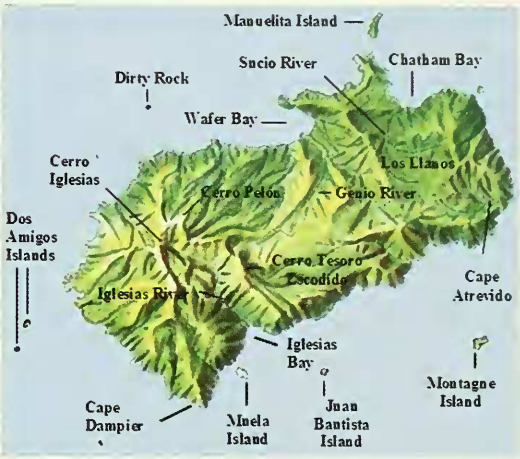

FIGURE 2. Map of Isla del Coco including collection localities. Map prepared by author.

Geology

Isla del Coco is the only portion of the submarine Cocos Ridge that rises above sea level. The island is volcanic in origin and is a product of the active and dynamic tectonics of the Cocos and Nazca plates. The Cocos Ridge was formed in the Miocene as the Galápagos hotspot alternated between the Cocos and Nazca plates across the zone of active plate tectonics known as the Galápagos Spreading Center (Castillo et al. 1988). Geological dates based on K/Ar and paleomagnetic data indicate that the island is between 1.9 and 2.4 Ma, much younger than the age of the Cocos Ridge (Bellon et al. 1984). Castillo et al. (1988) determined that Isla del Coco is the result of seamount volcanism superimposed upon this earlier hot-spot volcanism. In fact, the northern portion of the island is suggested to be the remains of the summit of the old Cocos seamount (Castillo et al. 1988). Isotopic analysis of the Cocos Island rock series indicates that the Cocos and Galápagos volcanic rocks share a common although heterogeneous mantel reservoir and that the young Cocos volcano is still a part of the Galápagos hot-spot signal (Castillo et al. 1988; Werner and Hoernle 2003). The island is composed mainly of basaltic rock and pyroclastic breccia in addition to a tracheyte dome at the northern end of the island (Chubb 1933; Castillo et al. 1988). The soils are very acidic entisols with low Ca, Mg, P and Na content (Brenes and Gonzalez 1995).

Werner and Hoernle (2003) have shown that many of the underwater seamounts that make up the Cocos, Nazca and Carnegie Ridge systems may have been above water during the last 17 million years. These "islands," thus, may have effectively formed an archipelago that could have served as "stepping-stones" for the flora and fauna of the Galápagos Islands and Isla del Coco.

Climate

Isla del Coco is the only humid oceanic island in the eastern Pacific Ocean (Costa Rica, Government of 1996). Like many tropical areas and oceanic islands, temperature varies little. The average recorded temperature is 25.5°C whereas the minimum is 23.1°C and the maximum is 27.6°C (Herrera 1984). Stewart (1912) reports the low temperature as 20°C and the high temperature as 33.3°C. In contrast, the high average yearly rainfall of 5000–7000 mm is not spread equally throughout the year. May and June receive the greatest rainfall with over 1000 mm whereas January through March receive around 200 mm (Herrera 1986). This rainfall maintains a positive hydrologic balance in the island and there is no true dry season (Montoya 1990).

The climate and seasonality of Isla del Coco are a product of its unique location within the Intertropical Convergence Zone (ITCZ). The ITCZ moves from 2–4° North latitude in February or April to 11–15° North latitude in August or September (Montoya 1990). During most of the year there is an eastward flowing equatorial counter current bringing clouds, rain and a persistent south-

east wind. In contrast, when the ITCZ is at its meridian in February or March, this current becomes a westward current bringing drier air.

Vegetation

Upon the first view of Isla del Coco, the rugged relief of the island is apparent. The coastline is irregular with cliffs rising almost vertically out of the sea to heights of up to 200 m. Beyond the narrow shore, green mountain ranges, separated by steep ravines, rise up in all directions. Pittier (1898) wrote "I believe that it would be difficult to find in all of the interior [of the island] a flat and horizontal space of half a kilometer". This imposing geography has protected the island from the impact of human colonization and provides a home to its unique flora and fauna.

There are seven major vegetation types on Isla del Coco: bayshore, coastal cliff, riparian, low elevation humid forest, high elevation cloud forest, landslide and islet. These vegetation types are subjectively identified by the authors from the interactions of elevation, topography, and hydrologic conditions. The main floristic elements of these plant communities and the degree of human disturbance in each of them are discussed below.

Bayshore communities: There are three natural bays on Isla del Coco: Chatham and Wafer Bays on the northwest side of the island offer protected anchorage for boats and are the traditional entrance points onto the island; Iglesias Bay on the southeast side of the island is much smaller and is affected by strong winds, waves, and currents. Chatham and Wafer Bays are home to the two park ranger stations and the original beach communities of these bays have been modified due to human activities. Wafer Bay has a small strip of sandy beach backed by a large grove of the trees, *Talipariti tiliaceum* var. *pernambucense* mixed with *Annona glabra, Terminalia catappa,* and a few large *Erythrina fusca* and *Ochroma pyramidale*. The vines *Mucuna sloanei, M. mutisiana,* and *Canavalia maritima* are found growing on these shoreline trees and shrubs. There is a small section of beach near the original ranger's station that has coconut palms (*Cocos nucifera*) and an understory of the herbs *Setaria geniculata, Sphagneticola trilobata,* and *Hydrocotyle umbellata.* Chatham Bay has a small area of sandy beach that is exposed only at high tide. The shoreline is steep behind the beach except for the small area near the mouth of the Chatham River. The river edge is mainly a grove of *Talipariti tiliaceum* var. *pernambucense*. Despite its name, there are relatively few coconut palms left on Isla del Coco. These are found in small isolated pockets of beach and at Iglesias Bay. Iglesias Bay is similar to Chatham Bay as it has no permanent sandy beach area. Wave action has pushed a wall of rocks up protecting a small area of beach vegetation from the wind and waves. The small grove of *Cocos nucifera* is formed along the floodplain area of the Iglesias River behind this natural seawall. In addition, beach morning glory, *Ipomoea pes-caprae* is found growing on rocks along with the fern *Blechnum occidentale*. There are no mangrove communities on Isla del Coco although the mangrove associate *Cassipourea guianensis* is occasionally found.

Coastal cliff communities: The steep slopes of Chatham Bay are representative of the cliff vegetation around the island. The open overstory is primarily the endemic *Cecropia pittieri* (Cecropiaceae) mixed with *Clusia rosea*. The overwhelming majority of the vegetation is a mixture of *Ipomoea* spp. vines forming a nearly vertical green wall. The sedge, *Rhynchospora polyphylla,* stinging nettle, *Laportea aestuans,* and red-flowered *Kohleria spicata* are some of the few herbaceous plants that are common on the cliffs near the shoreline. In less steep areas, the closed-canopy forest vegetation reaches to the shore. Here it is possible to find a canopy of the endemic tree *Sacoglottis holdridgei* (Humiriaceae) along with tree species *Ocotea insularis* and *Clusia rosea.* The understory is composed of melastome shrubs such as *Ossaea macrophylla* and *O. bracteata*. A unique feature of this vegetation is the presence of the endemic tree fern *Cyathea nesiotica*

(Cyatheaceae) which is restricted to these moderately steep areas that receive more sunlight. Many waterfalls cascade from these cliffs into the sea.

RIPARIAN AREAS: The unusually high rainfall and steep terrain of Isla del Coco support many streams and rivers. The largest and most permanent of these rivers are those leading into the three bays at Chatham, Wafer and Iglesias. The overstory of the riparian areas is the same as the rest of the island with an abundance of *Sacoglottis holdridgei*, *Ocotea insularis*, and *Clusia rosea* trees. The sedge, *Calyptrocarya glomerulata*, the aroid *Spathiphyllum laeve*, and the fern *Danaea nodosa* are abundant along river and stream banks throughout the island. At the lower elevations (0–50 m) of Wafer Bay, the Genio River and its tributary streams are home to *Rustia occidentalis* and *Pilea gomeziana*. The endemic *Hoffmannia piratarum* (Rubiaceae) is restricted to the Genio River riparian area.

The Iglesias River on the southwestern side of the island is only accessible for a short section from the waterfall to the sea. This area is home to a small grove of the endemic tree *Eugenia cocosensis* (Myrtaceae) and an understory including the shrub *Psychotria gracilenta*. The Chatham River leading to Chatham Bay is much steeper and has large boulder outcrops along the edges. The endemic shrub *Ardisia cuspidata* (Myrsinaceae) is common along the banks of this river.

LOW ELEVATION HUMID FOREST. The majority of the island is classified as premontane rain forest in the Holdridge life zone system (Holdridge 1974). Tree diversity is extremely low. Only five species of canopy trees were recorded in a study of all tree species over 10 cm diameter at breast height (dbh) in ten 400 m^2 plots along an east-west elevational transect from 30 m to the highest elevation at 630 msl on the north-eastern slope of Cerro Iglesias. These are *Sacoglottis holdridgei*, *Clusia rosea*, *Ocotea insularis*, *Henriettella fascicularis* and *Miconia dodecandra*. *Ficus pertusa*, *Eugenia cocosensis*, and *Brosimum* sp. are also found sporadically along the north side of the island. The shrub layer in this vegetation zone is dense and diverse with many melastomes and two common endemic tree fern species, *Cyathea alfonsiana* and *C. notabilis*. The sole forest palm is *Euterpe precatoria* var. *longevaginata*. The herbaceous layer consists mostly of fern species and the large sedge species *Hypolytrum amplum*. Thick lianas of *Schlegelia brachyantha* and *Entada gigas* wind through the trees. A notable aspect of this forest is the density and diversity of epiphytic species. The forest appears a mixture of green and red from the abundance of the bromeliad *Guzmania sanguinea* that covers nearly every tree. In addition, four orchid species are commonly found including the endemics *Epidendrum cocoënse* and *E. insulanum*. There are many epiphytic ferns and two endemic pendent epiphytes, *Huperzia brachiata* and *H. pittieri*.

HIGH ELEVATION CLOUD FOREST: The cloud forest on Cocos Island begins around 450 m elevation and is restricted to the two highest peaks on the island, Cerro Iglesias and Cerro Pelon. The canopy of this forest is exclusively *Sacoglottis holdridgei* with an understory largely dominated by the tree fern *Cyathea alfonsiana*. These large trees and tree ferns are completely covered in a thick layer of mosses and the whole forest constantly drips as the clouds roll over the peak. *Freziera calophylla*, *Hedyosmum racemosum* and the endemic fern *Elaphoglossum reptans* are known on Isla del Coco only from these cloud forests.

LANDSLIDES: Due to the abundance of rain and its rugged terrain, Cocos Island has many landslides both near the coast and inland (Fournier 1966). These open areas are quickly covered with the vining ferns *Dicranopteris flexuosa*, *D. pectinata* and *Sticherus remotus* and vines of several species of *Ipomoea*. These species are joined by *Cecropia pittieri*. These successional areas caused by landslides are common and probably constant features of the Cocos Island vegetation.

ISLETS: There are more than ten small islets surrounding Isla del Coco and three of them (Isla Manuelita, Isla Ulloa and Isla Muela) were visited during our research. These small islets do not contain much soil as a result of constant weathering by the wind and sea. Only two species of plants,

Clusia rosea and the endemic grass *Chloris paniculata* were recorded on these islets. The overwhelming majority of the plants of *Chloris paniculata* are found on these small islets although a few small sub-populations are found on the coastal cliffs of Isla del Coco near the islets.

Human Impacts

The biota of oceanic islands is unique and fragile. The paucity of species in island habitats increases the importance of the native species in ecosystem function and dynamics. The biological equilibrium of oceanic islands is very sensitive to any external alteration. The impact of humans and their introduced animals and plants on the biota of oceanic islands is well known (Moulton and Pimm 1986; Quammen 1996; Haberle 2003). There have been many examples of extinctions produced by the intentional or accidental intervention of man in fragile ecosystems such as islands. Isla del Coco is not excluded from this list. In the nearly 500 years since the island was discovered, man has impacted its ecosystems.

Human inhabitants: Isla del Coco has not had extensive human inhabitation. The island functioned as a prison colony between 1874 and 1877 in Chatham Bay (Alfaro 1898). The longest tenure any human has had living on the island was by August Gissler and his wife who spent 16 years from 1889 to 1905 in Wafer Bay. Gissler brought 13 German families to work in the Cocos Island Agricultural Company (Jinesta 1937), but very few families stayed for a second year. Today, the park has two stations, one in Chatham Bay that houses four people and the other in Wafer Bay that houses up to 30 people. The majority of the island has remained uninhabited. Recently, there has been a hydroelectric facility installed on the Genio River in Wafer Bay that provides power to the ranger station.

Introduced animals: In July of 1793 James Colnett, captain of the English whaler *Rather*, introduced pigs and goats onto the island (Lievre 1893). Today, the feral pig (*Sus scrofa*) is abundant and is one of the main threats for the native plants of Cocos Island. Although this introduction has had the greatest negative environmental impact on the island, it is not the only animal introduction. Paca (*Agouti paca*), white-faced monkeys (*Cebus capucinus*), domestic dogs (*Canis familiaris*), domestic rabbits (*Oryclolagus cuniculus*) and guinea hens (*Numida meleagris*) have all been introduced (Madrigal 1954; Rojas 1964). However, none of these introduced vertebrates have prospered, and they do not occur on the island today. The current introduced fauna of the island consists of feral pigs, feral cats (*Felis domesticus*), goats (*Capra hircus*), white-tailed deer (*Odocoileus virginianus*) and two species of rats (*Rattus rattus* and *Rattus norvegicus*) (Montoya 1990; Gómez 2004).

An estimated 400–500 feral pigs occur on Isla del Coco (Sierra 2001a). Research has shown that areas rooted by the feral pig population have a rate of soil erosion nearly 100 times greater than unrooted areas and that 10–20% of the total island surface is rooted annually by these animals (Sierra 2001b). Rooting is a major soil disturbance and can increases the loss of soil nutrients (Singer et al 1984). Rooting diminishes the abundance of soil arthropods (Vtorov 1993) and reduces and/or modifies the structure of the herbaceous vegetation (Bratton 1974; Diong 1982). In addition, Sierra (2001a) found that 88% of the stomach contents of the feral pigs is vegetable matter, with 63% fruits of Moraceae spp., *Annona glabra*, and *Ocotea insularis*. Sierra (2001a) did not find that the pigs were dispersing the seeds of any exotic species. Park officials have approved the eradication of feral pigs (Montoya 1990) but are awaiting funding.

Studies of the rat populations of Isla del Coco have added to our knowledge of their impacts on the island. Gómez (2004) found that rat densities on the island range from 45 rats/ha in the cloud forest of the island to a high of 156 rats/ha near the inhabited area of Wafer Bay. Rats are also found on many of the islets near the island. Gómez (2004) also found that 70% of the stomach contents

of these animals is vegetable matter. In addition, he found that 68% of seeds of the endemic tree *Sacoglottis holdridgei* were gnawed on by rats (Gómez (2004).

INTRODUCED PLANTS: The first account of exotic plant species on Isla del Coco was by Don Francisco Bernardo de Quiroz in 1546 who wrote, " I planted some plants and fruits brought from Peru" (Sierra 1998). This early account was only 20 years after the discovery of the island. Passmore (1895) recorded pumpkins and grapes on the island, while Pittier (1898) recorded jocote (*Spondias lutea*), achiote (*Bixa orellana*), and marañones (*Anacardium occidentale*). August Gissler (1889–1905) and his Cocos Island Agricultural Company cultivated a large area in Wafer Bay with bananas, beans, cacao, coffee, corn, avocado, achiote, sugar cane, oranges, limes, pineapples, tobacco, cherimola, almonds and yuca (Jinesta 1937). Today, avocado, bananas, cacao and coffee remain from Gissler's fields. In addition, the park service personnel maintain several tropical fruits and vegetables in cultivation for their own consumption. The only cultivated plant that has managed to escape into at least two known forested areas of the island is the shade-loving coffee plant.

It is uncertain to what extent the species with extensive, worldwide or pantropical distributions have reached the island because of human intervention. Drift disseminated species such as *Cocos nucifera*, *Mucuna sloanei*, and *Ipomoea pes-caprae* have seeds that can survive and germinate after long periods floating at sea (Guppy 1906). The propagules of weedy species such as *Rolandra fruticosa, Urena lobata* and *Drymaria cordata* are small and can be moved by wind or can be easily dispersed by migrating birds (Ridley 1930; Carlquist 1970). In contrast, a number of plant species are commonly associated with humans. Species such as *Sida acuta*, *Phyllanthus urinaria*, *Hydrocotyle umbellata* and many grass and sedge species are usually found only in human disturbed areas or around dwellings. It is likely that these species were accidentally introduced by humans. Unfortunately, due to the lack of early plant collections, knowing whether a plant is native but widely distributed or whether it has been accidentally introduced is a difficult distinction to make. For this publication, any ruderal species first found after 1905 is considered accidentally introduced by humans unless there is evidence to the contrary. This date was chosen because it is the date of the first fairly complete plant collection for the island published by Stewart (1912). By these criteria, we consider 71 species to have been intentionally or accidentally introduced to Isla del Coco by humans in the last 100 years.

DEFORESTATION: The most apparent impact man has made on the vegetation of Isla del Coco is through deforestation. Many mariners cut wood or collected coconuts from the islands throughout its history. Lievre (1893) stated that many coconuts were collected by felling the coconut palms. This activity led to the 1895 account that there were no coconut palms on Isla del Coco (McCartney 1895). Despite this extensive harvesting, coconuts can still be found in isolated coastal locations. The deforested areas of Isla del Coco are limited to the areas near Chatham and Wafer Bays. The area near Chatham Bay was deforested for agriculture in 1874 by the penal colony and despite the cessation of agriculture for the past 125 years, remains deforested to this day (Alfaro 1898; Sierra 1998).

Previous Botanical Research

Although the island had been known to mariners since the sixteenth century (Hertlein 1963) the first known plant collections from Isla del Coco were made in 1838 by George W. Barclay during the voyage of H.M.S. *Sulfur* (Belcher 1843). Fifty years after these initial collections, Alexander Agassiz of Harvard University collected a number of plants in 1888 and 1891 during expeditions of the United States Fish Commission (Agassiz 1891–1892). Agassiz, like many of the subsequent plant collectors, spent a few days on Isla del Coco as a stop during his trip to the Galápagos Islands. Six years after Agassiz' expedition, the Costa Rican government funded Anastasio Alfaro, Henri

Pittier and Paul Biolley to visit in 1898 and 1902 in the interest of re-instating the use of the island as a penal colony (Pittier 1898). The three naturalists suggested that the island should be conserved as a protected area instead. Pittier's plant collections are the basis of nine species endemic to Cocos Island (Pittier 1898). Robert E. Snodgrass and Edmund Heller, naturalists aboard the Hopkins-Stanford Expedition in 1899, also collected on Cocos Island (Robinson 1902). One of the most complete early botanical expeditions to Cocos Island was accomplished by Alban Stewart who collected in 1905 for the California Academy of Sciences (Stewart 1912).

Interest in plant collecting on Isla del Coco was renewed in the 1930s with the Vincent Astor expedition of 1930 with botanist Henry K. Svenson (Svenson 1935, 1938) and during the Templeton-Crocker Expedition sponsored by the California Academy of Sciences in 1932 with the plant collections of John T. Howell. The Presidential Cruise of the United States stopped on Cocos Island in 1935, 1937 and 1940 and collections were made and sent to the United States National Herbarium. In 1964, W.L. Klawe collected Isla del Coco plants as part of the Galápagos Islands International Scientific Project (Fournier 1966; Fosberg and Klawe 1966).

Plant collecting on Cocos Island has greatly increased in the last decades due to the establishment of Isla del Coco National Park and the availability of transportation to the island. The majority of this work has been conducted by Costa Rican botanists from the Universidad de Costa Rica, Universidad Nacional de Costa Rica and the Instituto Nacional de Biodiversidad. Collectors include Gregorio Dauphin, Robin Foster, Luis Diego Gómez, Jorge Gómez-Laurito, Jose González, Leslie R. Holdridge, Alfonso Jiménez, Eduardo Lépiz, Luís Poveda, Francisco Quesada, Alexander Rojas, Pablo Sánchez, Ricardo Soto, and Manuel Valerio. Table 1 (See Appendix) gives a summary of the most important historical botanical collections from Isla del Coco with details on the dates, institutions/countries which organized these expeditions, and the locations of the specimens collected.

Despite the number of collectors who have visited the island, there are relatively few published works on the plants of Isla del Coco and no complete flora has been assembled. The earliest published records of vascular plants for Isla del Coco are those of Bentham (1844–1846), Rose (1892), Pittier (1898), Robinson (1902), Stewart (1912) and Svenson (1935, 1938). It was not until 1966 when Fosberg and Klawe published the "Preliminary List of Plants from Cocos Island" that this information was assembled for the island (Fosberg and Klawe 1966). Many new collections have been made since this checklist was published and better taxonomic and floristic treatments have aided in the identification of previous collections and in the description of new species (e.g., Gómez 1971; Burger 1975; Gómez 1975; Gómez 1976; Hamilton 1988; Rojas-Alvarado 2003; Rojas-Alvarado and Trusty 2004). The present work, synthesizes over 150 years of collection data along with data from recent expeditions, stands as the first complete flora for this island.

Botanical work that makes up this volume: We have compiled a list of all the species previously collected or currently present on Isla del Coco and have updated the taxonomy and nomenclature for these species. This research is based both on the study of herbarium specimens and also on material collected by us during our recent expeditions to Cocos Island. Three collecting trips were made between 2001 and 2002: Trusty (July 2001), Trusty and Kesler (January–March 2002) and Trusty and Kesler (November–December 2002). A total of 497 numbers was collected during these three trips. Complete sets of these collections can be found in the Museo Nacional de Costa Rica (CR) and Fairchild Tropical Botanic Garden (FTG); partial sets are located in the California Academy of Sciences (CAS), the Instituto Nacional de Biodiversidad (INB), and Universidad de Costa Rica (USJ). In addition, the original plant collections of all published species were reviewed in CR, USJ, INB, the Gray Herbarium at Harvard (GH), and the Smithsonian Institution (US). Loans were obtained of collections from Isla del Coco housed at the California Academy of Sciences (CAS), the Brooklyn Botanic Garden (BKL) and US. More than 1800 specimens were

studied including historical and type collections. These collections were verified and annotated. On the basis of these specimens and current taxonomic treatments, we recognize 263 species on Isla del Coco. Fifty-one species are new records for the island. Twenty-eight of these were collected by J. Trusty. Eleven previously published species are either excluded from the flora or are considered as doubtful occurrences. In addition, information about species' abundance and distribution on the island is provided. The abundance designations are: rare, infrequent, frequent, locally common, common and very common. These are subjective assessments made by the authors based on the frequency of encounter from least to greatest. The List of Exiccatae provides a summary of the herbarium specimens that are the basis for this flora.

Plant Biogeography

The known native vascular flora of Isla del Coco now stands at 263 species. One of these is identified only to genus (*Brosimum* sp.) due to lack of adequate material. Of the 262 identified species, 37 are endemic to the island and 154 are considered native. Seventy-one species are considered introduced by humans. A summary is given in Appendix Table 2.

Endemic species: Isla del Coco is home to 33 endemic plant species and four endemic varieties representing 24% of the native flora. This rate is relatively low when compared to other islands or archipelagos in the Pacific. The nearby Galápagos Island flora boasts an endemism rate of 43%, the Juan Fernandez Islands have 60%, while Hawaii boasts 97% (Wagner et al. 1990; Lavergne et al. 1999, Baeza et al 2002). Single islands such as Rodriques, La Réunion and Mauritius have endemism ranges between 29–45% (Lavergne et al. 1999). The small size and young age of Isla del Coco may influence the low rate of endemism on this island.

Six genera on Isla del Coco have more than one endemic species on the island (*Cyathea*, 3 spp.; *Elaphoglossum*, 3 spp.; *Epidendrum*, 3 spp.; *Eugenia*, 2 spp.; *Hoffmannia*, 2 spp. and *Miconia*, 2 spp.). Preliminary molecular evidence for *Epidendrum* and *Miconia* (J. Trusty et al., in prep.) and morphological assessments for *Cyathea* do not suggest the endemic species to be sister taxa (M. Turner, pers. commun.). This evidence suggests that although a moderate number of new species has evolved on the island, a radiation event has not occurred. Most endemic species on Isla del Coco are the result of separate introductions from the mainland.

The endemic flora of Isla del Coco is unique in that 50% of the endemics are fern species. In no other island flora does the number of fern endemic species equal that of flowering plant endemics (Smith 1972; Given 1993). In addition, the total fern diversity is high, with 80 species making up 30% of the total flora of Isla del Coco. In comparison, ferns in continental areas represent a much smaller proportion of the flora. For example, ferns constitute only 9% of the vascular plant diversity of Costa Rica (Moran 1993).

Origin of the flora: The majority of the species on Isla del Coco are considered to be Central or South American in origin due to the proximity of the island (500 km) to mainland Costa Rica. The distributional ranges of the native species are listed in the Species Descriptions and a summary is given in Appendix Table 3. The floristic affinities of the endemic species based on the distribution of putative sister species are compiled in Appendix Table 4. The close relationship of the Isla del Coco flora with the Caribbean Islands and Central America is shown with 66.8% of all Cocos Island native taxa present on at least one island in the Caribbean and 95.7% present in Central America. This biogeographic relationship was suggested by Croizat (1958) who considered Isla del Coco to be a part of a biogeographical track that joins the Caribbean, Central America and the Galápagos Islands. This biogeographical track has been confirmed by the geological and tectonic history of the region (Rosen 1976; Haug and Tiedemann 1998). To date, no floristic links have been

found between Isla del Coco and the Galápagos Islands and they only have 26 plant species in common (Trusty et al., in prep.). Approximately 30% of plants native to Cocos Island are pantropical in distribution.

Using the guidelines proposed by Carlquist (1974), the most likely dispersal mode was determined for each species found on Isla del Coco based on seed size, palatability for birds, presence/absence of appendages or glands, ability to float and/or published dispersal mode (Carlquist 1974; Croat 1978; STRI 2004; NYBG 2004; data available from J. Trusty on request). The results of this analysis are shown in Appendix Table 5. Approximately 47.1% of native species are considered dispersed by wind, 11.5% by water, 26.7% internally by birds and 14.7% externally by birds.

Wind patterns: The climate of Isla del Coco is determined by the northern and southern migration of the Inter-Tropical Convergence Zone (ITCZ). The ITCZ is an air current that moves from 2–4° North latitude between February and April to 11–15° North latitude between August and September. During most of the year there is an eastward flowing equatorial counter current bringing clouds, rain and a persistent southeast wind. In contrast, when the ITCZ is closest to Isla del Coco in February or March, the equatorial current becomes a westward current bringing drier air (Montoya 1990).

The majority of wind-dispersed plants is fern or orchid species due to their minute spores and seeds. Ferns and orchids are predisposed to the colonization of insular environments due to their incredible dispersal abilities. Fern spores are microscopic with nearly 80% of pteridophyte species within a range of 20 to 60 micra in diameter (Tryon 1970). The small size of fern spores allows them to be easily transported by air currents, and it has been said that distances of 800 km is not a significant barrier (Tryon 1970).

Orchid seeds are often described as "dust-like" and range in size from 150 to 6000 micra in diameter (Molvray and Kores 1995). The seeds also have large internal air spaces that allow them to float on air for long periods of time, facilitating long distance transport (Arditti and Ghani 2000). In addition to the ease of transport, fern spores and orchid seeds are particularly numerous; a single plant can produce thousands of propagules at one time and many millions in a lifetime (Carlquist 1965; Arditti and Ghani 2000). Once the propagules have arrived, the wet, tropical environment on Isla del Coco is beneficial to the establishment and survival of fern and orchid species. Although air currents flow westward from the mainland of Central America/northern South America for only a small part of the year, many fern and orchid species have successfully made the voyage to Isla del Coco as evidenced by the high proportion of these plants in the total flora.

Due to the remarkable dispersal ability of ferns and orchids, it is surprising that these air dispersed groups make up the majority (56.8%) of endemic species on Isla del Coco. If large numbers of orchid seeds and fern spores were continuously colonizing the island, the genetic input of these mainland populations would prevent the Isla del Coco populations from diverging into new species via genetic drift or selection. Unless the island populations had developed a method of reproductive isolation via mutation or chromosome rearrangement, the influx of mainland genes would reunite the island population with the mainland species and likely swamp out the traits under selection in the island environment (Templeton 1982, Futuyma 1998). The presence of 18 endemic fern taxa and three endemic orchid species indicates that although ferns and orchid propagules are able to survive the long journey to Isla del Coco, this event is rare for many species.

Ocean currents: Isla del Coco is situated in the eastern Pacific where a complex series of marine currents join. The system of ocean currents that influences the island is made up of three main components: strong eastern circulating currents that transport warm tropical water along (and slightly north) of the equator two western circulating cold currents that parallel the warm equatori-

al current on each side a complex of minor currents that originate on the coast of Central and South America and influence ocean patterns up to 800 km from that coast.

The interplay and influence of any one of these currents are variable within each year and from year to year (Montoya 1990). In addition, each current also responds to patterns of atmospheric circulation. The warm eastern flowing Northern Equatorial Countercurrent (NECC) circulates between 4–10 degrees N latitude and is particularly influenced by the northern and southern migrations of the ITCZ. The two cold currents do not directly affect the island but act on the range and movement of the NECC. Finally, the warm Costa Rican, Colombian and Peruvian coastal currents influence the development and occurrence of the El Niño Southern Oscillation (ENSO), which can provoke catastrophic disequilibria in marine and terrestrial environments of the region through increased ocean temperatures.

Overseas flotation is the least common mode of dispersal to Isla del Coco for plant species. Only a small and specialized group of beach strand species commonly uses flotation as a dispersal route. These species are often extremely widespread throughout tropical areas as a result of the effectiveness of flotation as a dispersal method. A number of common coastal, drift-seeded species such as *Ipomoea pes-caprae*, *Cocos nucifera*, *Mucuna* spp. and *Caesalpinia bonduc* are present on the island. Mangrove species, which are common drift fruits, are not found on Isla del Coco but this may be due to the lack of protected beachfront. Due to the frequent input of propagules to Isla del Coco, most drift dispersed species are not reproductively isolated from conspecific mainland populations and are prevented from diverging into new species. In fact, only a single endemic species, *Sacoglottis holdridgei,* on Isla del Coco is considered related to a plant whose propagules can be dispersed by water. Interestingly, *S. holdridgei* and its putative sister species, *S. ovicarpa*, are closed-canopy forest species and not common in beach strand ecosystems. It is likely that the ecological preferences of these species help to maintain the genetic and morphological distinctness of each taxon.

Bird Visitation: Isla del Coco is home to three endemic species of birds but is visited by many other bird taxa. A compiled checklist of bird species lists 97 taxa with the majority of these as nonbreeding visitors (Slud 1967; Sherry and Werner 1984; Costa Rica, Government of 1996). These visiting birds are able to move plant propagules in a number of different ways. The most common form of bird dispersal is internal (Carlquist 1974). Many birds are frugivorous and eat a wide variety of fruits and seeds. Proctor (1968) and De Vlaming and Proctor (1968) have shown that shorebirds can retain seeds in their digestive system for up to 300 hrs. Birds may also move seeds on external portions of their bodies. Morphological adaptations of externally-dispersed seeds include the presence of bristles and/or barbs or viscid glands which aid the seeds in sticking to the bird's feathers and legs. Other seeds dispersed by birds, such as many grass and sedge species, are small and common in muddy areas. It is thought that these species are often moved in the mud stuck to the legs and feet of migrating birds.

Bird dispersal of plant propagules, internally and/or externally, is common on Isla del Coco. Forty-one percent of all native plant species on the island are presumed to have been dispersed by birds. Internal bird dispersal is the only explanation for many large or fleshy-fruited plant species such as many taxa in the families Rubiaceae, Melastomataceae and Myrtaceae. The apparent frequency of internal bird dispersal to Isla del Coco is surprising. Of the 52 plants that are believed to have been internally dispersed to the island, only 12 are endemic species. This implies that the majority of these native plants are internally bird-dispersed to the island with enough regularity to prevent these species from diverging via genetic drift or selection and becoming reproductively isolated from mainland populations. In addition, internal bird dispersal is more common than external bird dispersal for Cocos Island plants (27.2% vs. 14.1%).

Three endemic species are considered to be externally bird-dispersed species (*Chloris paniculata, Kyllinga nudiceps*, and *Pilea gomeziana*). These taxa have small seeds (often with appendages to aid in attachment) and are found in muddy and/or coastal habitats. The progenitors of these species, which presumably shared these seed dispersal characteristics, were most likely picked up on the body or feet of a bird and carried to the island.

Introduced species: A total of 71 plant species has been introduced by humans to the island, representing 27% of the flora of Isla del Coco. In comparison with other island systems in the Pacific, this is a remarkably low figure. Lavergne et al. (1999) found that introduced species outnumber the native species in all of the Pacific Islands they studied except for the Galápagos where 45% of the flora is introduced. Lonsdale (1999) in his study of worldwide plant invasions found that on average 13% of introduced species become invasive. Invasive species can rapidly alter island ecosystems. Many islands have encountered the extinction of native plant and animal species due to invasive exotics (Baeza et al. 2002; Leon de la Luz et al. 2003). Eradication of exotic species that have become naturalized can be extremely time-consuming and costly (Cronk and Fuller 1995; Pimental et al. 2000).

The majority of Isla del Coco has not been impacted by invasive exotic species but as visitation and tourism increase, it is likely that the number of introduced or exotic species on Isla del Coco will grow. Quick and decisive removal of introduced plant species on the island will be imperative to the continued success of the native flora. In addition, inspection and monitoring of goods brought to the island are some of the mechanisms that should be implemented in order to minimize the accidental introduction of exotics to this island. We have noted in the remarks (see List of Vascular Plants) those species introduced to Isla del Coco that are invasive in other island ecosystems. We recommend their timely removal to prevent these species from becoming naturalized within the island.

Description of Terms

The families used are those currently accepted by the publication "Plant Systematics" by Judd et al. (2002). This work recognizes a broad Malvaceae that includes Sterculiaceae, Tiliaceae, and Bombacaceae. In addition, the Apocynaceae includes species previously included in Asclepiadaceae. *Chrysobalanus* is recognized in the Chrysobalanaceae and not Rosaceae. *Muntingia* is included in the Muntingiaceae not Elaeocarpaceae and *Scoparia* is included the Plantaginaceae not Scrophulariaceae. Finally, *Schlegelia* is included in the Schlegeliaceae and not Bignoniaceae.

Synonyms are listed after the species names. This list of synonyms does not include all possible nomenclatural synonyms but only synonyms for those species that have been published in the previous floristic treatments of the island by Rose (1892), Pittier (1898), Robinson (1902), Stewart (1912), Svenson (1935, 1938) and Gómez (1975, 1976). The list of pteridophytes is based on the publication by Rojas-Alvarado and Trusty (2004). All author abbreviations follow Brummitt and Powell (1992). Species descriptions are provided for the endemic species. The endemic species are highlighted in bold type while species introduced by humans are marked with an asterisk.

Catalog of Species

Key to the Families of Pteridophytes on Isla del Coco

1. Plants with no leaves or roots; stems dichotomously branching; sporangia trilocular ..... Psilotaceae
1. Plants with leaves; sporangia unilocular. 2
  2. Leaves with a single unbranched vein. 3
    3. Fertile cones 4-sided; leaves oblong to ovate; heterosporous. ..... Selaginellaceae
    3. Fertile cones round in cross-section or sporangia in axils of unmodified leaves; leaves sharp-pointed, usually linear; homosporous ..... Lycopodiaceae
  2. Leaves complex, veins branched. 4
    4. Sporangia born on erect spikes or panicles from near the base of the blade ..... Ophioglossaceae
    4. Sporangia on back of blade or sometimes born on modified fronds or parts of fronds 5
      5. Stems tree-like. ..... Cyatheaceae
      5. Stems not tree-like 6
        6. Petiole with one vascular bundle 7
          7. Vascular bundles of petiole U-shaped or Ω-shaped (with the open end of the "U" or omega oriented adaxially) when viewed in cross-section ... 8
            8. Leaves forked; petiolar vascular bundle with enrolled arms ..... Gleicheniaceae
            8. Leaves not forked; petiolar vascular bundle without enrolled arms ..... Dennstaedtiaceae (in part)
          7. Vascular bundles of the petiole terete 9
            9. Lamina one cell thick between the veins, translucent ..... Hymenophyllaceae
            9. Lamina more than one cell thick between the veins, opaque 10
              10. Plants epiphytic; fronds pendulous, simple, entire; rhizome scales clathrate. ..... Vittariaceae
              10. Plants epiphytic or not; fronds various; rhizome scales clathrate or not. 11
              11. Leaves jointed to phyllopodia, arranged in two rows on the dorsal side of the stem ..... Polypodiaceae
              11. Leaves not jointed to phyllopodia; arranged radially on the stem 12
                12. Rhizome scales peltate; sori indusiate ... Oleandraceae
                12. Rhizome scales basifixed or absent; sori exindusiate ..... Grammitidaceae
        6. Petiole with two or more vascular bundles 13
          13. Petioles with two vascular bundles. 14
            14. Vascular bundles terete ..... Pteridaceae
            14. Vascular bundles elongated or strap-shaped 15
              15. Vascular bundles free in the distal part of the petiole; lamina often 1-pinnate-pinnatifid; trichomes unicellular, acicular, bifurcate or stellate ..... Thelypteridaceae
              15. Vascular bundles united in the distal portion of the petiole; tri-

chomes multicellular 16
16. Scales generally clathrate; sori thinly elongate to linear . . . . . Aspleniaceae
16. Scales not clathrate; sori rounded or if elongate or linear, paired back to back on the same nerve . . . . . Woodsiaceae
13. Petioles with three or more vascular bundles 17
17. Petiolar vascular bundles arranged in concentric circles. 18
18. Blades 1-pinnate; veins netted; rachis without pulvinus-like thickening at junctures with costae; fleshy, ear-like stipules absent at petiole base . . . . . Pteridaceae (*Acrostichum*)
18. Blades 2-5-pinnate; veins free; rachis with pulvinus-like thickening at junctures with costae; fleshy, ear-like stipules present at petiole base . . . . . Marattiaceae
17. Petiolar vascular bundles arranged in one circle 19
19. Rhizome and petiole base hairy . . . . Dennstaedtiaceae (in part)
19. Rhizome and petiole base scaly 20
20. Blades 1-pinnate, with a small fiddlehead at the tip; pinnae jointed to the rachis; hydathodes conspicuous; plants stoloniferous . . . . . Oleandraceae (*Nephrolepis*)
20. Plants not as above 21
21. Sporangia completely covering the back of the leaf, not in sori 22
22. Rhizome creeping, in cross-section with a broad, ventral vascular bundle . . . . . Lomariopsidaceae
22. Rhizome creeping to erect, in cross-section with a ventral vascular bundle the same size and shape as the dorsal bundles . . . . . Dryopteridaceae
21. Sporangia grouped in sori of diverse types 23
23. Rachis and costae pubescent on the upper surface; sori dorsal between the costa and the margins of the lamina . . . . . Tectariaceae
23. Rachis and costae glabrous on the upper surface; sori elongated to linear and parallel along the costae . . . . . Blechnaceae

Aspleniaceae

1. Rhizome creeping; leaves proximal to remote . . . . . *Asplenium dissectum*
1. Rhizome erect to curved-ascendant or sometimes procumbent; leaves grouped 2
2. Pinnae conspicuously pedicellate, at least the basal and medial portions, 2 mm or longer . . . . . *Asplenium delicatulum* var. *cocosensis*
2. Pinnae sessile, subsessile or briefly pedicellate up to 1 mm. 3
3. Rachis with thin green margins proximally . . . . . *Asplenium abscissum*
3. Rachis with green wings . . . . . *Asplenium barclayanum*

1. *Asplenium abscissum* Willd., Sp. Pl. 5:321. 1810.

Distribution.— Rare; collected once on Cerro Tesoro Escondido on Isla del Coco. Distributed from southern Florida and Mexico to Brazil and Uruguay; also found in the Greater and Lesser

FIGURE 3. *Asplenium barclayanum* (drawn from *Trusty 126*). A. Habit of plant showing a single frond. B. Abaxial view of frond showing sori.

Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Gómez 3333*; *Gómez 3334*; US: *Gómez 3333*.

2. ***Asplenium barclayanum*** C.D. Adams, Novon 2:290. 1992. (Fig. 3)

TYPE: *Barclay 2196* (holotype: BM).

Rhizome 1–3 × 0.2–0.4 cm, suberect or shortly creeping; scales 1–5 × 0.2–0.8 mm, elongate-deltate from a rounded auriculate base, tapered to a short hair tip, remotely denticulate, flat or slightly crispate, clathrate, dark brown or blackish with narrow paler margins, slightly lustrous, eventually reniform, clustered over rhizome apex and extending to base of petiole only; leaves 11-38 cm long, tufted or closely approximate; petiole 2–8 cm long, purplish or grayish brown, narrowly green-winged from near base, brittle with residual vascular shreds; blade 9–30 × 2–2.5 cm, 2-pinnate-pinnatifid, lanceolate, gradually narrowed to base, with apex shortly accuminate, nonconform; rachis green-winged adaxially, widening at pinna bases and laterally to ca. 1 mm or more overall below the tip, confluent with pinna-bases on the basiscopic side, rounded and purplish brown abaxially, becoming stramineous or green distally, with a few short glandular hairs near junctions with pinnae; pinnae 0.5–3 × 0.4–1.2 cm, the longest submedial, stalked to less than 1 mm long, 15–30 pairs, obliquely deltate to lanceolate in outline, with a distinct 2–4-lobed pinnule proximally on the acroscopic side and up to 6 uniform pairs of simple or shortly forked lobules; costae prominent adaxially, winged throughout; proximal pinnules 3–5 × 2–4 mm, subflabellate; terminal segment linear, ascending-lobulate; ultimate segments to ca. 4 × 1 mm, linear or oblong, obtuse or emarginate, herbaceous, glabrescent, scarcely discolorous; veinlets simple or 1-forked in the lobed segments, evident, ending in linear hydathodes well short of the margins; sori 0.5–3 mm, solitary or double and sometimes continous around the veinlet-tip; indusia 0.4–0.5 mm wide, hyaline, colorless or light brown with broadly rounded entire or shortly erose margin, gaping and pocketlike at maturity; spores ca. 42 × 30 mm, light brown, reniform-ellipsoid with a loose, unsculptured, sparsely rugose perispore.

DISTRIBUTION.— Locally frequent; found on the cliffs near the pools of the two large waterfalls near Wafer Bay. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 3337*; *Gómez 4536*; *Gómez 6561*; *Quesada 1060*; *Rojas 3777*; FTG: *Trusty 126*; *Trusty 390*; *Trusty 469*; *Trusty 490*; GH: *Svenson 339*; INB: *Quesada 1060*; *Rojas 3777*; NY: *Rojas 3777*; US: *Gómez 6561*; *Pittier 16235*; *Snodgrass and Heller 954*; *Stewart 228*; *Svenson 339*.

3. ***Asplenium delicatulum*** C. Presl var. ***cocosensis*** A. Rojas & Trusty, Brenesia 62: 3. 2004.

TYPE: *Rojas 3777* (holotype: INB; isotypes: CR, MO, NY, UC, US).

Differs from the type variety by its terrestrial or epiphytic habit (vs. epiphytic), more developed leaves (7–15 cm long vs 3.3.–9 cm) and is 1-pinnate-pinnatifid vs. 2-pinnate-pinnatifid. It is included in *A. delicatulum* for the size of the petiole, the form of the lamina, and the proliferous roots.

DISTRIBUTION.— Rare; found only near the waterfall in Iglesias Bay. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 6555*; *Gómez 6562* (not seen).

4. *Asplenium dissectum* Sw., Podr. 130. 1788

DISTRIBUTION.— Rare; found on Cerro Iglesias above 300 msl on Isla del Coco. Distributed throughout Mesoamerica to Brazil; including the Greater Antilles (except Puerto Rico).

SPECIMENS EXAMINED.— CR: *Rojas 3619*; FTG: *Trusty 183*; *Trusty 287*; INB: *Rojas 3619*.

BLECHNACEAE

5. *Blechnum occidentale* L., Sp. Pl. 1077. 1753.

DISTRIBUTION.— Rare; found near the Pittier River in Iglesias Bay on Isla del Coco. Distributed from the United States to northern Argentina and Chile; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Rojas 3776*; FTG: *Trusty 398*; INB: *Rojas 3776*.

CYATHEACEAE

1. Petioles and costae covered with short, fine hairs . . . . . *Cyathea nesiotica*
1. Petioles and costae lacking hairs 2
   2. Nerves of pinnae bifid . . . . . *Cyathea alfonsiana*
   2. Nerves of pinnae simple . . . . . *Cyathea notabilis*

6. ***Cyathea alfonsiana*** L.D. Gómez, Amer. Fern J. 61:166. 1971. (Fig. 4)

TYPE: *Gómez 3349* (holotype: CR; isotypes: F, GH, US!).

Trunk up to 3 m tall, ca. 50 cm diameter, apex in petiole basally dense paleaceous, palea oblong-lanceolate, bicolored, middle reddish brown, margins cream-white; leaf scars obvious, stipes occasionally persistant, the upper side of the rachis canaliculate and pilose, lower side of rachis glabrous, spines sparse, small, apex nearly round; pneumatophores not obvious; primary costae pilose above, glabrous below, secondary costae pilose above, paleaceous below, paleas numerous nearly appressed lemon-yellow hyaline, membranes bulliform; petiolar hairs on upper side of rachis, costa, and costule multicellular, ferruginous, attenuate, thick, rigid, apex obviously curved; foliar lamina oblong-lanceolate, 1.4 m long, 80–90 cm wide, bipinnate-pinnatifid; basal pinnae abruptly reduced, apex pinnatisect; pinnae 12–15 (21) pairs, alternate to subalternate, 6–8 cm long, 2 cm wide, nearly divided to the costa, segments up to 14 pairs, alternate, oblong, basal pinnae somewhat constricted, 7–9 mm long, 4–5 mm wide, smooth lobate, apex subcrenulate, veins 7–8 pairs, 1–3 times furcate; sori inframedial, indusiate. Indusium squamiform, small.

DISTRIBUTION.— Common throughout the island from 50–630 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 4504*; *Gómez 4517*; *Gómez 18045*; *González 1164*; *González 1169*; *González 1208*; *Quesada 1016*; *Quesada 1089*; *Rojas 3635*; FTG: *Trusty 30*; *Trusty 152*; *Trusty 192*; *Trusty 322*; *Trusty 528*; *Trusty 529*; INB: *González 1164*; *González 1169*; *González 1208*; *Quesada 1016*; *Quesada 1089*; *Rojas 3635*; US: *Gómez 3349*; *Schnitt 129*; *Schnitt 130*; *Schnitt 131*.

7. ***Cyathea nesiotica*** (Maxon) Domin, Acta Bot. Bohem. 9:140. 1930.

TYPE: *Pittier 16229* (holotype: US!).

Stem to 8 m tall; petiole with hairs and spines, pale, the tricomes 1–3 mm long, the scales not visible, bicolored, clear brown with white borders, without dark denticulations; lamina 2-pinnate-pinnatifid, the apex uniformly attenuate, pinnatifid; pinnae sessile; pinnules 6–10 × 1.5–2.3 cm, sessile; final segments 20–28 pairs per pinnule, 2–3 mm wide, pinnatifid, the lobes less retuse than the apex; rachis, costa and costules with hairs, apparently without scales, the tricomes 1–3 mm, white, acicular; nerves 8–11 pairs per segment, 1–2-bifurcate, with sparse hairs; lamminar tissue between the nerves glabrous; sori inframedial; paraphyses inconspicuous, shorter than the sporangia, red-brown, turgid; indusium absent.

DISTRIBUTION.— Frequent along the rocky shoreline and in partially open habitats from 0–200 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 3317*; *Gómez 4507*; *Gómez 4519*; *Jiménez 3143*; *Quesada 1102*; *Rojas 3680*; FTG: *Trusty 164*; *Trusty 263*; *Trusty 491*; *Trusty 527*; INB: *Quesada 1102*; *Rojas 3680*; US: *Barclay 2208*; *Fisher s.n.*; *Gómez 3317*; *Gómez 4507*; *Jiménez 3143*; *Pittier 16229*; *Snodgrass and Heller 964*.

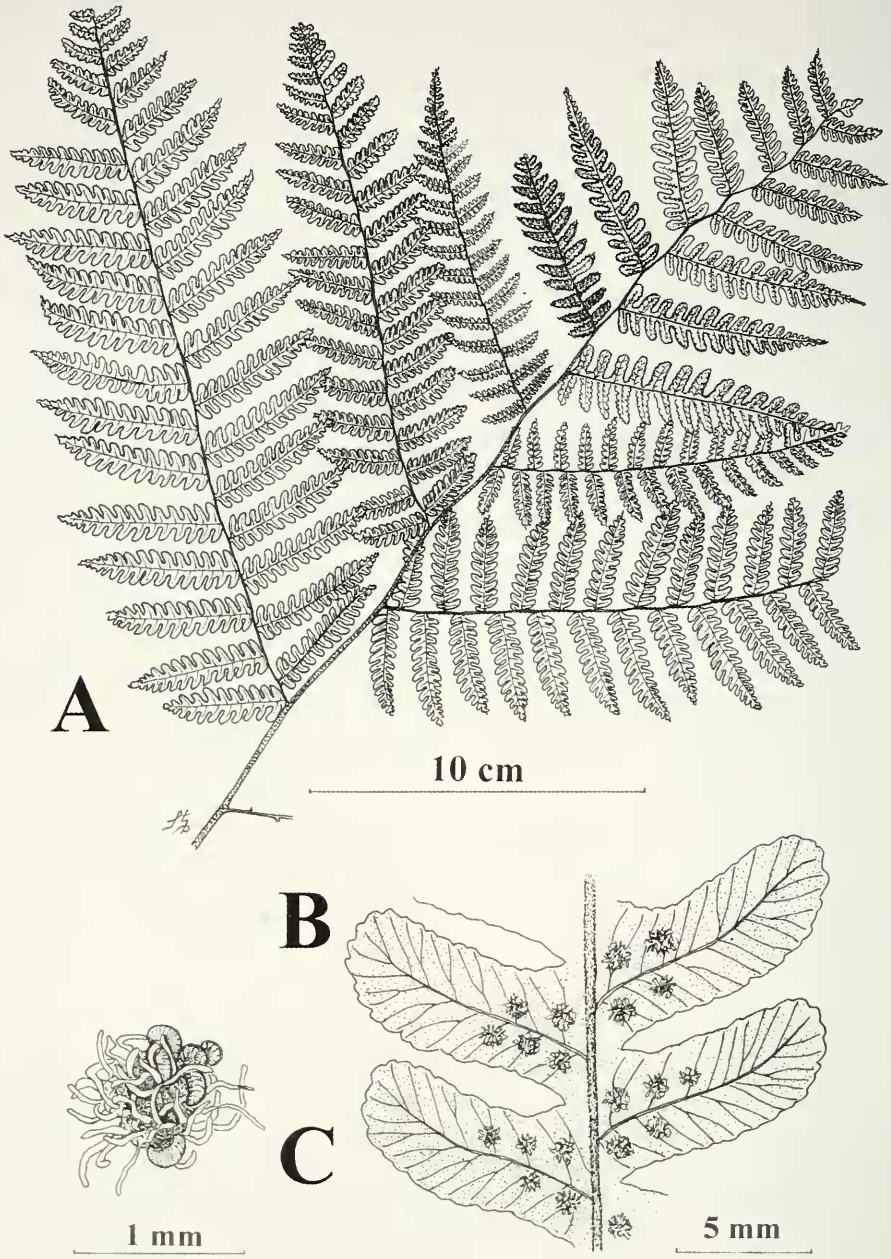

FIGURE 4. *Cyathea alfonsiana* (drawn from *Trusty 152*). A.Terminal portion of frond. B. Close up of pinna showing sori. C. Close up of sorus.

8. ***Cyathea notabilis*** Domin, Acta Bot. Bohem. 9:141. 1930.

TYPE: *Pittier 12355* (holotype: US!).

Stem to 2 m tall; petiole straw colored, with remote raised dots, scales 10–20 × 2.5–5 mm, lanceolate to ovate, bicolorous, light brown to yellowish with a lighter border; lamina 2-pinnate-pinnatifid, the apex pinnatifid; pinnae sessile or pedicellate, the pedicel up to 1 cm; pinnules 3–4 × 0.8–1 cm, sessile, the final segments 8–13 pairs per pinnule, 2–4 mm wide, serrate; rachis and costa with hairs, the trichomes 0.3–0.5 mm, cylindrical, erect; costules with scales, the scales golden or brown, bulliform, entire; nerves 5–7 per segment, not bifurcate, with hairs, the trichomes erect, white; the laminar tissue between the nerves glabrous; sori medial; paraphysis 3–4 times longer then the sporangia, very enlarged basally, not colored; indusium squamiform, small, adpressed to the lamina, sometimes obscured below the sporangia and paraphyses.

DISTRIBUTION.— Common throughout the island from 50–200 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Barclay s.n.*; *Dauphin 1118*; *Fournier 331*; *Gómez 3330*; *González 1163*; *Jiménez 3146*; *Klawe s.n.*; *Rojas 3590*; *Rojas 3774*; FTG: *Trusty 31*; *Trusty 153*; *Trusty 190*; *Trusty 191*; *Trusty 334*; *Trusty 476*; *Trusty 533*; GH: *Gómez 3330*; INB: *González 1163*; *Rojas 3590*; *Rojas 3774*; NY: *Fournier 331*; *Gómez 3330*; US: *Barclay s.n.*; *Gómez 3330*; *Klawe s.n.*; *Pittier 12355*; *Pittier 16228*; *Schmitt 128*.

DENNSTAEDTIACEAE

1. Sori 1-nerved 2
   2. Indusium simple, formed only by the recurved margin and the lamina; spores monolete . . . . . *Hypolepis lellingeri*
   2. Indusium double, formed by an internal and external portion of the lamina; spores trilete 3
      3. Rhizome erect or decumbent, covered by the old petiole bases, squamous . . . . . *Saccoloma elegans* var. *spinosa*
      3. Rhizome short to long creeping, not covered by the old bases of the petiole, hairy . . . . . *Dennstaedtia dissecta*
1. Sori 2- to multinerved 4
   4. Ultimate segments diminished in size . . . . . *Lindsaea lancea* var. *lancea*
   4. Ultimate segments not diminished . . . . . *Pteridium feei*

9. *Dennstaedtia dissecta* (Sw.) T. Moore, Index Fil. 305. 1861.

DISTRIBUTION.— Found in closed canopy forest throughout Isla del Coco. Distributed from southern Mexico to Peru and southern Brazil; also found in the Greater Antilles and Trinidad.

SPECIMENS EXAMINED.— FTG: *Trusty 47*; *Trusty 123*; *Trusty 305*; *Trusty 409*; GH: *Svenson 343*; INB: *González 1190*; *Rojas 3650*; US: *Barclay 2207*; *Gómez 3357*; *Klawe 1540*; *Pittier 12358*; *Pittier 12358*; USJ: *Soto s.n.*

10. ***Hypolepis lellingeri*** A. Rojas, Rev. Biol. Trop. 49: 439–441. 2001. (Fig. 5)

TYPE: *A. Rojas 3617* (holotype: INB!; isotypes: CR, MO).

Terrestrial; rhizome 3–5 mm diameter, creeping, dark brown to black, densely covered by trichomes 1.0–2.5 mm long, dark brown to dark purple; leaves 120–160 cm long, with determinate growth, erect; petiole 40–70 cm long, 40 mm diameter, generally dark brown to black at the base, clear brown to pale yellow distally, densely spiney, with spines commonly 0.5–1 mm long (also small buds) with the apex black and in the form of a cup upon which grows a glandular hair, the trichomes 0.5–2.5 mm long, brown to pale yellow, dense and 0.2–0.5 mm long, not glandular, pale

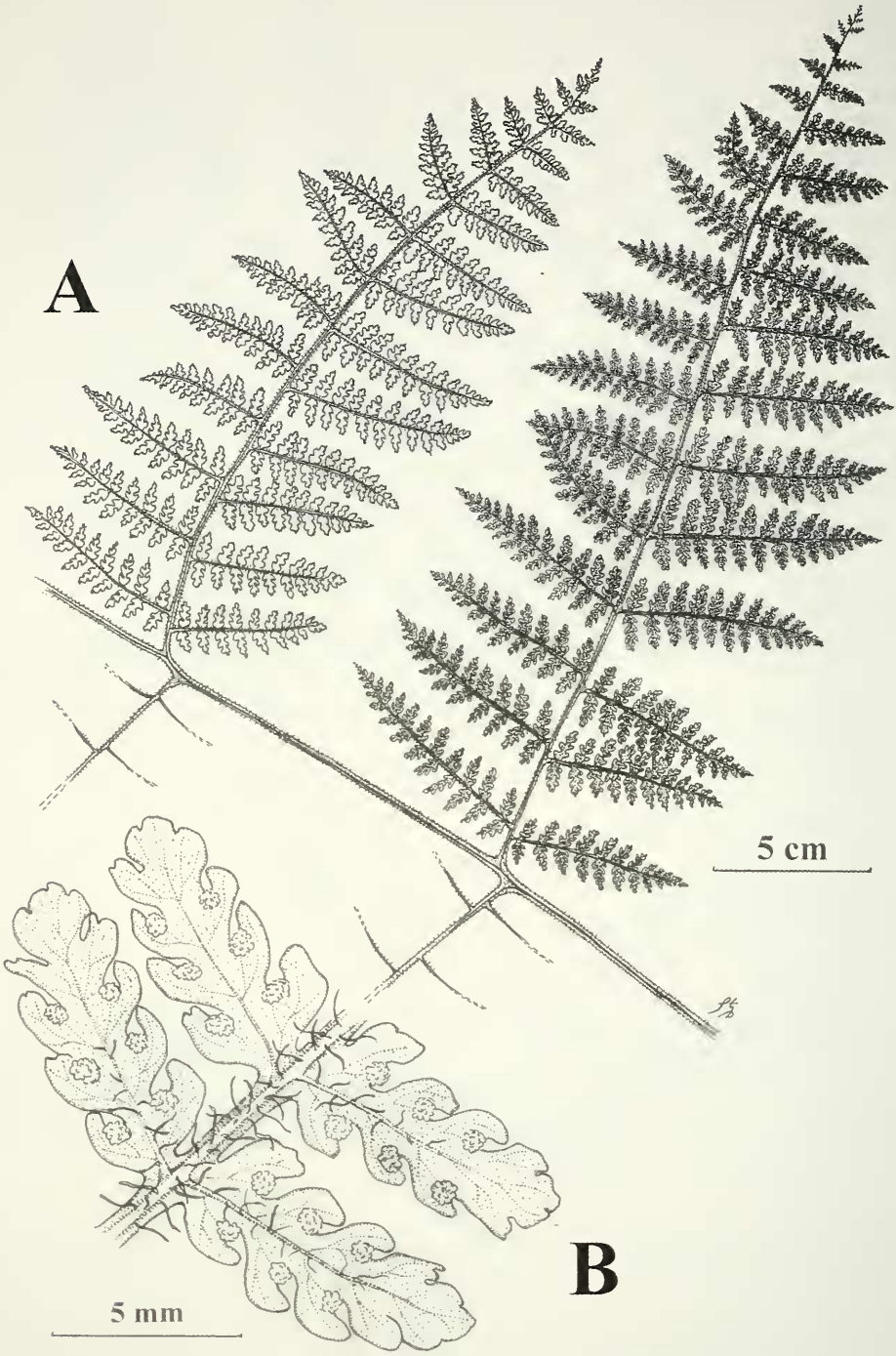

FIGURE 5. *Hypolepis lellingeri* (drawn from *Trusty 42*). A. Portion of frond showing two pinnae. B. Close up of pinnule showing marginal sori.

yellow, scarce, cateniform; lamina 75–90 × 80–100 cm, deltate, 3-pinnate-pinnatifid for the total extension; rachis brown yellow to pale green, erect (not flexuose), spiny-strigose, spines and buds as in the petiole but less dense and smaller towards the apex, pilose, the trichomes as on the petiole, dense, brown to pale yellow, cateniform; 10–15 pairs of pinnae, opposite to subopposite, the basal pinnae 30–45 × 20–30 cm, lanceolate; costae strigose, pale green to green yellow, densely pilose on both sides, the trichomes 0.5–1.0 (1.5) mm, glandular, cateniform, clear brown to pale green, mixed with smaller non-glandular trichomes; pinnules commonly 5–10 (15) × 1.5–2.5 (5.5) cm, lanceolate to linear, 10–20 pairs; costules pale yellow to yellow-green, winged (except in the basal pinnae), densely pilose on both surfaces, the trichomes 0.2–1.0 mm, glandular and eglandular, cateniform, pale; segments of the third order 0.7–1.0 (2.0) × 0.24–0.4 (0.8) cm, pinnate in the basal pinnae, not bordered adaxially by perpendicular and decurrent herbaceous wings; segments crenulate to pinnatified, pilose along the length of the central vein, the trichomes similar to those of the costules, cateniform, occasionally with glands at the tip (also on the secondary veins of the basal pinnae), glabrous on the laminar tissue, the margin glabrous; sori round, submarginal; indusium 0.2–0.5 mm wide, entire, scarious; paraphyses absent.

Distribution.— Infrequent but locally common, in forest gaps and trail edges from 0–250 msl. Endemic to Isla del Coco.

Specimens examined.— CR: *Barclay 2201*; *Gómez 4514*; *Gómez 18090*; *González 1221*; *Rojas 3617*; FTG: *Trusty 250*; *Trusty 326*; *Trusty 42*; *Trusty 499*; INB: *González 1221*; *Quesada 1085*; *Rojas 3617*; US: *Barclay s.n.*; *Svenson 341*.

11. *Lindsaea lancea* var. *lancea* (L.) Bedd., Suppl. Ferns S. Ind. 6. 1876.

Distribution.— Extremely common throughout Isla del Coco. Distributed from Mexico to Peru and Brazil; also found in the Antilles and Trinidad.

Specimens examined.— CR: *Holdridge 5146*; *Jiménez 3158*; *Klawe s.n.*; *Lépiz 355*; *Quesada 1017*; *Soto s.n.*; FTG: *Trusty 149*; *Trusty 229*; *Trusty 302*; *Trusty 365*; GH: *Svenson 433*; INB: *Lépiz 355*; *Quesada 1017*; USJ: *Soto s.n.*

12. *Pteridium feei* (W. Schaffn. ex Fée) Faull, Contr. Arnold Arbor. 11:87. 1938.

Distribution.— Rare; in Wafer Bay and along the trail to Chatham Bay on Isla del Coco. Distributed from central Mexico to Panama.

Specimens examined.— INB: *Rojas 3685*.

13. ***Saccoloma elegans*** Kaulf. var. ***spinosa*** A. Rojas & Trusty, Bresenia 62:3. 2004.

Type: F. *Quesada 1082* (holotype: INB!; isotypes: CR, MO).

Differs from the continental material by the dark brown rhizome scales (vs. brown-yellow); the base of the stipe has dispersed spines vs. densely spiny; the pinnas are wider [1.7–2.5 (–3.0) cm wide vs. 2.5–4.5 cm] and the basal pinnae have the base widely cuneate to truncate (vs. narrowly cuneate) and are more irregularly shaped (the basiocopic side is more concave).

Distribution.— Frequent, locally common from 0–250 msl. Endemic to Isla del Coco.

Specimens examined.— INB: *González 1172*; *Quesada 1082*; *Rojas 3612*; USJ: *Soto s.n.*; FTG: *Trusty 150*; *Trusty 249*; *Trusty 325*.

Dryopteridaceae

1. Lamina with an apical pinna similar in form to the lateral pinnae; vascular bundles placed irregularly, not surrounded by a dark sclerified vein . . . . . *Olfersia cervina*
1. Lamina with a pinnatifid apex; vascular bundles placed in concentric rings, each one surrounded by a dark sclerified vein 2

2. Sterile lamina 1-pinnate . . . . . *Polybotrya polybotryoides*
2. Sterile lamina 2-pinnate pinnatifid . . . . . *Polybotrya osmundacea*

14. *Olfersia cervina* (L.) Kunze, Flora 7:312. 1824.

DISTRIBUTION.— Common throughout the closed canopy forest of Isla del Coco. Distributed throughout the Neotropics.

SPECIMENS EXAMINED.— CR: *Dauphin 1129*; *Gómez 3351*; *Jiménez 3157*; *Lépiz 341*; *Sánchez 36*; *Quesada 1008*; *Rojas 3585*; *Rojas 3585*; *Valerio 1084*; FTG: Trusty 99; *Trusty 379*; *Trusty 487*; INB: *Lépiz 341*; *Quesada 1008*; *Rojas 3585*.

15. *Polybotrya osmundacea* Humb. & Bonpl. ex Willd., Sp. Pl. 5:99. 1810.

DISTRIBUTION.— Extremely common throughout the closed canopy forest of Isla del Coco. Distributed from Mesoamerica to Peru and northern Brazil; also found in the Antilles.

SPECIMENS EXAMINED.— CR: *Gómez 4535*; *Gómez 4537*; *Valerio 2225*; FTG: *Trusty 151*; *Trusty 246*; *Trusty 314*; *Trusty 503*; INB: *González 1188*; *Rojas 3591*; USJ: *Soto s.n.*

16. *Polybotrya polybotryoides* (Baker) H. Christ, Bull. Herb. Boissier ser. 2, 1:70. 1901

DISTRIBUTION.— Frequent in closed canopy forest of Isla del Coco from 0-400 msl. Distributed from southern Mexico to Ecuador and Peru.

SPECIMENS EXAMINED.— CR: *Gómez 4541B*; *Jiménez 3209*; FTG: *Trusty 488*; INB: *Rojas 3578*; *Rojas 3581*; *Rojas 3669* USJ: *Soto s.n.*

GLEICHENIACEAE

1. Rhizome and axillary buds hairy; sporangia 6-20 per sorus; nerves 2-4 bifurcate 2
   2. Accessory pinnae present in all of the bifurcations except terminal . *Dicranopteris flexuosa*
   2. Accessory pinnae absent . . . . . *Dicranopteris pectinata*
1. Rhizome and axillary buds with scales; sporangia 2-5(6) per sorus; nerves simple or 1-bifurcate 3
   3. Second to the last segments 1.2-2.5(3) cm wide . . . . . *Sticherus rubiginosus*
   3. Second to the last segments (2.5)4-9 cm wide 4
      4. Scales of the bud pale orange to brown-orange, ciliate, the cilia lax, pale . . . . . *Sticherus palmatus*
      4. Scales of the bud brown to blackish, erose-ciliate to setose, the bristles erect, dark . . . . . *Sticherus remotus*

17. *Dicranopteris flexuosa* (Schrad.) Underw., Bull. Torrey Bot. Club 34:254. 1907.

DISTRIBUTION.— Common in disturbed areas and landslides on Isla del Coco. Distributed from the southeastern Unites States and Mexico to Brazil and Paraguay; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Rojas 3627*; INB: *Rojas 3627*.

18. *Dicranopteris pectinata* (Willd.) Underw., Bull. Torrey Bot. Club 34:260. 1907.

DISTRIBUTION.— Extremely common in disturbed areas and landslides throughout Isla del Coco. Distributed from Southern Mexico to Peru and Brazil; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Gómez 4523*; *Rojas 3622*; FTG: *Trusty 155*; *Trusty 266*; GH: *Holdridge 5152*; *Svenson 332*; INB: *Rojas 3622*.

19. *Sticherus palmatus* (W. Schaffn. ex E. Fourn.) Copel., Gen. Fil. (Ann. Cryptog. Phytopathol.) 5:28. 1947.

DISTRIBUTION.— Common in disturbed areas and landslides above 400 msl on Isla del Coco. Distributed from Mexico to Panama; also found in Jamaica and Cuba.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 268*.

20. *Sticherus remotus* (Kaulf.) Chrysler, Amer. J. Bot. 31:483. 1944.

DISTRIBUTION.— Locally common near Cerro Pelón on Isla del Coco. Distributed from Costa Rica to Brazil; also found in Cuba and Trinidad.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Rojas 3605*; FTG: *Trusty 294*; INB: *Rojas 3605*.

21. *Sticherus rubiginosus* (Mett.) Nakai, Bull. Natl. Sci. Mus. 29:28. 1950.

DISTRIBUTION.— Locally common along the trail from Wafer Bay to Chatham Bay on Isla del Coco. Distributed from Costa Rica to Peru and Bolivia; also found in Trinidad.

SPECIMENS EXAMINED.— CR: *Rojas 3628*.

GRAMMITIDACEAE

1. Lamina simple, entire, with the border sclerified, black or brown-black. . . *Grammitis bryophila*
1. Lamina simple, lobate or pinnate, without a sclerified border, black not brown-black. 2
   2. Hydathodes absent or inconspicuous. 3
      3. Lamina simple, differentiated into sterile and fertile parts, the sterile leaves and often the sterile portion of the fertile leaves serrate-dentate . . . . . *Cochlidium serrulatum*
      3. Lamina simple or pinnate, not sub-dimorphic nor differentiated into sterile and fertile portions . . . . . *Ceradenia pruinosa*
   2. Hydathodes present adaxially at the termination of the nerves. 4
      4. Nerves of the pinnae simple or with a single acroscopic nervule; lamina less than 1 cm wide, narrowly linear . . . . . *Micropolypodium taenifolium*
      4. Nerves of the pinnae with more than one ramification; lamina more than 1 cm wide, linear to narrowly ovate . . . . . *Terpsichore cocosensis*

22. *Ceradenia pruinosa* (Morton) L.E. Bishop, Amer. Fern J. 78:5. 1988.

DISTRIBUTION.— Rare on Isla del Coco, collected on Cerro Pelón. Distributed from southern Mexico to southern Venezuela and Brazil.

SPECIMENS EXAMINED.— INB: *Rojas 3602*; *Rojas 3718*.

23. *Cochlidium serrulatum* (Sw.) L.E.Bishop, Amer. Fern. J. 68:80. 1978.

DISTRIBUTION.— Infrequent epiphyte on *Sacoglottis holdridgei* above 300 msl on Isla del Coco. Distributed from southern Mexico to Peru and Brazil; also found in the Antilles, Africa, Madagascar, Maritius and Amsterdam Island.

SPECIMENS EXAMINED.— CR: *Gómez 3340*; *Klawe s.n.*; *Lellinger and de la Sota 773*; FTG: *Trusty 129*; *Trusty 171*; *Trusty 269*; *Trusty 377*; GH: *Holdridge 5138*; *Howell 10189*; INB: *Quesada 1030*; *Rojas 3600*.

24. *Grammitis bryophila* (Maxon) F. Seym., Phytologia 31:172. 1975.

DISTRIBUTION.— Infrequent; found in the cloud forest above 400 msl on Isla del Coco. Distributed from Costa Rica to Peru and Bolivia.

SPECIMENS EXAMINED.— FTG: *Trusty 267*; *Trusty 378*; INB: *Rojas 3604*.

25. *Micropolypodium taenifolium* (Jenman) A. R. Sm., Novon 2:423. 1992.

DISTRIBUTION.— Rare; found in the cloud forest above 400 msl on Isla del Coco. Distributed from southern Mexico to Ecuador and the Guianas; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— FTG: *Trusty 248*; *Trusty 291*; INB: *Quesada 1078.1*; *Rojas 3603*.

26. ***Terpsichore cocosensis*** A. Rojas, Brenesia 45-46:47-49. 1996.

TYPE: *Lépiz 337* (holotype: INB!; isotypes: CR, MO, UC).

Epiphyte; rhizome 1–2 mm in diameter, short creeping to ascendent; rhizome scales absent; fronds from 25–45 (50) cm long, 1.3–2.0 cm wide, linear, decumbent; stipe 1–3 cm long, 0.5 mm diameter, pilose, the hairs 1–3 mm long, gold-red; lamina 6–10 mm long, 3–5 mm wide, 1-pinnate, linear lanceolate, pinnae basifixed and a little reduced at the base, apex acute to obtuse; lamina hairs on both surfaces, the abaxial face 0.5–1 mm long, golden, hairs of the adaxial face, rachis and costa 2–4 mm long, the margin of the pinnae stellate basally, golden-red; sori rounded, on the apical half of the pinnae, 3–7 sori per pinna; paraphyses absent; sporangia setose.

DISTRIBUTION.— Common in the closed canopy forest from 100–400 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Fournier 332*; *Rojas 3616*; FTG: *Trusty 55*; Trusty *143*; *Trusty 407*; *Trusty 537*; GH: *Holdridge 5136*; *Pittier 12353*; INB: *Lépiz 337*; *Rojas 3616*; NY: *Fournier 332*; *Rojas 3616*.

HYMENOPHYLLACEAE

1. Indusium 2-valved; receptacle generally not prolonged more than the border of the indusium . 2
    2. Lamina glabrous . . . . . *Hymenophyllum polyanthos*
    2. Lamina pelose, the trichomes on the nerves, the margins and the laminar tissue . . . . . *Hymenophyllum cocosense*
1. Indusium tubular, sometimes two-labiate but not 2-valvate; receptacle prolonged more than the border of the indusium 3
    3. Nervation anadromous, pinnate; lamina 1–4 pinnate-pinnatifid 4
        4. Rhizome long creeping with leaves distant; plants epiphytic or rupicolous 5
            5. Rhizome 1–2 mm in diameter or more; petiole winged . . . . . .*Trichomanes collariatum* var. *alvaradoi*
            5. Rhizome 0.1–1 mm in diameter; petiole not winged . . . . . .*Trichomanes capillaceum* var. *cocos*
        4. Rhizome decumbent to erect with fasciculate leaves; plants terrestrial 6
            6. Petiole and rachis not winged . . . . . .*Trichomanes rigidum*
            6. Petiole and rachis winged . . . . . .*Trichomanes elegans*
    3. Nervation catadromous or flabellate; lamina simple to 1-pinnate pinnatifid 7
        7. Margins of the lamina with paired suborbicular scales . .*Trichomanes membranaceum*
        7. Margins of the lamina glabrous or with bifurcate or stellate trichomes 8
            8. Leaves 0.2–3 cm; rhizome creeping 9
                9. Leaves with a false submarginal nerve, the margins glabrous; indusium immersed, the margins without dark cells . . . . . *Trichomanes kapplerianum*
                9. Leaves without a false sugmarginal nerve, the margins with bifurcate or stellate trichomes; indusium exerted or immersed, the margins of the indusium generally with one or more rows of dark cells . . . . *Trichomanes angustifrons*
            8. Leaves 4–70 cm; rhizome decumbent to erect, sometimes creeping 10

10. False nerves absent. . . . . *Trichomanes galeotii*
10. False nerves present 11
11. Rhizome erect or suberect; leaves fasciculate, not adherent to the substrate; false nerves abundant, perpendicular to the true nerves . . . . . *Trichomanes pinnatum*
11. Rhizome creeping; leaves distant, adhering to the substrate; false nerves scarce, near the margins and parallel to the true nerves . . . . . *Trichomanes ankersii*

27. ***Hymenophyllum cocosense*** A. Rojas, Brenesia 45–46:37. 1996.

TYPE: F. *Quesada 1015* (holotype: INB!; isotypes: CR, MO, NY).

Epiphyte or terrestrial; rhizome creeping, 0.3–0.4 mm in diameter; rhizome hairs ca. 0.5 mm long; fronds 5.5–11 cm long, determinant growth, erect to slightly pendulous, rigid, commonly separated by (0.8) 1.5–3.5 cm; stipe 0.6–4.3 cm long, 0.3–0.4 mm in diameter, not winged, rachis linear to a little flexuose, slightly winged to not winged, the wing from 0.1 (0.2) mm, with stellate hairs with 3–4 rays; lamina 3.5–7.5 cm long, 1.5–2 cm wide, pinnate-pinnatisect, elliptic to linear-elliptic, with the basal pinnae reduced and the apex acute on fertile fronds and obtuse in sterile fronds; pinnae 0.3–1.5 cm long, flat, with hairs on the margins and the veins, the hairs ca. 0.2 mm long, bifurcate to stellate with 3–4 rays (rarely simple or twice-bifurcate); segments commonly (2) 3–5 mm long and 0.5–1 (1.5) wide, 1–4 pairs per pinna, simple or bifurcate; indusium rounded, 0.6–0.8 mm in diameter, inbedded in the lamina, slightly wider than the segment, found on the terminal half of the frond, 1–12 per pinna; receptacle not exerted.

DISTRIBUTION.— Common from 100–630 msl throughout the island. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 18063*; *Gómez 18068*; *Quesada 1015*; *Rojas 3601*; FTG: *Trusty 180*; *Trusty 270*; *Trusty 274*; *Trusty 328*; *Trusty 376*; *Trusty 411*; GH: *Holdridge 5139*; INB: *Quesada 1015*; *Rojas 3601*; US: *Holdridge 5139*; *Stewart 253*; USJ: *Dauphin 1167.*

28. *Hymenophyllum polyanthos* (Sw.) Sw., J. Bot. (Schrader) 1800(2):102. 1801.

DISTRIBUTION.— Extremely common throughout the closed canopy forest on Isla del Coco. Distributed from central Mexico to Peru, Bolivia and southern Brazil; also found in the Antilles, East Asia and Africa.

SPECIMENS EXAMINED.— CR: *Gómez 3329*; *Gómez 4553*; *Gómez 18058*; *Gómez 18067*; *Gómez 18070*; *Gómez 18094; Klawe s.n.*; FTG: *Trusty 137*; *Trusty 54*; *Trusty 179*; *Trusty 330*; GH: *Holdridge 5137*; *Svenson 345*; INB: *Rojas 3615*; US: *Gómez 3329*; *Holdridge 5137*; *Stewart 252*; *Svenson 345.*

29. *Trichomanes angustifrons* (Fée) Wess. Boer, Fl. Netherl. Antilles 1(Pterid.):17. 1962.

Distribution.—Frequently found in Wafer Bay and along the trail from Wafer Bay to Cerro Iglesias on Isla del Coco. Distributed from Mesoamerica to Peru, Brazil and Paraguay; also found in the Antilles.

SPECIMENS EXAMINED.— CR: *Gómez 4545*; *Gómez 6565*; *Gómez 18062*; *Rojas 3679*; *Rojas 3719*; INB: *Rojas 3679*; *Rojas 3719*; US: *Gómez 6565*; *Klawe s.n.*

30. *Trichomanes ankersii* C. Parker ex Hook. & Grev., Icon. Filic. 2:t.201. 1831.

Distribution.—Infrequently collected along the trail from Wafer Bay to Cerro Iglesias on Isla del Coco. Distributed from Mesoamerica to Peru, Bolivia and Brazil.

SPECIMENS EXAMINED.— CR: *Holdridge 5143*; *Rojas 3664*; FTG: *Trusty 327*; INB: *Rojas 3664*; US: *Klawe s.n.*

31. ***Trichomanes capillaceum*** L. var. ***cocos*** (H. Christ) L.D. Gómez, Brenesia 6:37. 1975.

TYPE: *Pittier 12390* (holotype: US!).

Differs from the type variety by the length of the ultimate segments 10–25 mm long (vs. 2–5 mm).

DISTRIBUTION.— Common epiphyte on *Cyathea* sp. throughout the island. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Dressler 4462*; *Gómez 3214A*; *Gómez 18069*; *Jiménez 3164*; *Klawe s.n.*; *Rojas 3636*; FTG: *Trusty 144*; *Trusty 293*; GH: *Holdridge 5135*; INB: *Rojas 3636*; US: *Foster 4165*; *Gómez 3314A*; *Pittier 12393*; *Svenson 349*; *Svenson 349*; USJ: *Soto s.n.*

32. ***Trichomanes collariatum*** Bosch var. ***alvaradoi*** A. Rojas, Lankesteriana 4(2):145–147. f.2. 2004.

Differs from var. *collariatum* by the shorter >20 cm (vs. 40 cm) and ovate (vs. elliptical) fronds.

DISTRIBUTION.— Common near stream edges and on wet rocks from 0–300 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 3318A*; *Gómez 3345A*; *Gómez 4543*; *Gómez 4547*; *Gómez 6557*; *Gómez 18093*; *Jiménez 3208*; *Sánchez 29*; *Quesada 1116*; *Valerio 30417*; FTG: *Trusty 225*; *Trusty 299*; *Trusty 517*; INB: *Rojas 3651*; US: *Fricke s.n.*; *Gómez 3318A*; *Gómez 3345A*; *Klawe s.n.*; *Stewart 233*; *Svenson 338*.

33. *Trichomanes elegans* Rich., Actes Soc. Hist. Nat. Paris 1:114. 1792.

DISTRIBUTION.— Frequent; found near small streams from 0–300 msl on Isla del Coco. Distributed from Mesoamerica to Peru, Bolivia and Brazil; also found in the Lesser Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Gómez 3319*; *Gómez 3328*; *Gómez 4527*; *Gómez 4527A*; *Gómez 18038*; *Gómez 18073*; *Klawe s.n.*; *Lépiz 331*; *Quesada 1010*; *Soto s.n.*; FTG: *Trusty 473*; INB: *González 1198*; *Lépiz 331*; *Quesada 1010*; *Rojas 3610*; US: *Barclay 2206*; *Gómez 3319*; USJ: *Lépiz 331*; *Soto s.n.*

34. *Trichomanes galeottii* E. Fourn., Bull. Soc. Bot. France 15 :147. 1868.

DISTRIBUTION.— Common in closed canopy forest from 0–450 msl on Isla del Coco. Distributed from southern Mexico to western Columbia; also found in Cuba.

SPECIMENS EXAMINED.— CR: *Gómez 4548*; *Gómez 18060*; *Gómez 18071*; *Gómez 18080*; *Jiménez 3162*; *Klawe s.n.*; *Lépiz 338*; *Quesada 1014*; *Rojas 3662*; FTG: *Trusty 34*; *Trusty 105*; *Trusty 227*; *Trusty 292*; *Trusty 323*; *Trusty 368*; *Trusty 372*; INB: *Lépiz 338*; *Quesada 1014*; *Rojas 3559*; *Rojas 3662*; US: *Foster 4161*; *Gómez 3343*; *Jiménez s.n.*; *Klawe s.n.*; USJ: *Dauphin 1166*; *Soto s.n.*

35. *Trichomanes kapplerianum* J. W. Sturm in Mart., Fl. Bras. 1(2):276. 1859.

DISTRIBUTION.— Frequent on wet boulders near the Chatham River in Chatham Bay on Isla del Coco. Distributed from Costa Rica to Peru and Brazil; also found in the Lesser Antilles.

SPECIMENS EXAMINED.— CR: *Gómez 6566*; *Gómez 6568*; *Gómez 18098*; FTG: *Trusty 474*; INB: *Rojas 3663*; US: *Svenson 344*.

36. *Trichomanes membranaceum* L., Sp. Pl. 1097. 1753.

DISTRIBUTION.— Infrequent on Isla del Coco; found near Iglesias Bay. Distributed from southern Mexico, to Peru and Boliva; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Gómez 3332*; *Gómez 4541A*; *Gómez 4546*; *Rojas 3775*; INB: *Rojas 3775*; US: *Gómez 3332*; USJ: *Dauphin 1012*; *Dauphin 1138*.

37. *Trichomanes pinnatum* Hedw., Fil. Gen. Sp. t.4, f. 1. 1799.

DISTRIBUTION.— Infrequent on Isla del Coco; found between Iglesias Bay and Cerro Tesoro Escondido. Distributed from Mexico to Peru, Bolivia and southern Brazil; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Quesada 1123*; INB: *Quesada 1123*; *Rojas 3773*; FTG: *Trusty 289*; *Trusty 369*; *Trusty 381*; *Trusty 382*; INB: *Rojas 3611*; US: *Gómez 6567*.

38. *Trichomanes rigidum* Sw., Podr. 137. 1788.

DISTRIBUTION.— Infrequent in closed canopy forest above 250 msl on Isla del Coco. Distributed from southern Mexico to Peru, Boliva and southern Brazil; also found in the Antilles and the Old World tropics.

Specimens examined.—CR: *Gómez 6567*; INB: *Rojas 3611*; FTG: *Trusty 289*; *Trusty 369*; *Trusty 381*; *Trusty 382*.

LOMARIOPSIDACEAE

1. Sterile leaves with linear-lanceolate scales generally enrolled to appear to be subulate trichomes, at least on the petiole, but in general on all of the leaf 2
   2. Lamina 10–22 cm wide, widely oblong, the apex obtuse; nerves reticulate . . . . . *Elaphoglossum crinitum*
   2. Lamina 2–10 cm wide, lanceolate, narrowlly elliptic to oblanceolate, the apex acuminate to rounded; nerves free . . . . . *Elaphoglossum auripilum* var. *longipilosum*
1. Sterile leaves densely squamose to nearly glabrous; scales diverse but not subulate;. 3
   3. Leaves pendent. 4
      4. Scales of the lamina limited to the margins and the costa, the rest of the laminar surface without scales . . . . . *Elaphoglossum decoratum*
      4. Scales of the lamina not limited to the margins and the costa, with some types of scales in one or both surfaces of the lamina . . . . . *Elaphoglossum cocosense*
   3. Leaves erect 5
      5. Leaves separated by 20–30 mm along rhizome . . . . . *Elaphoglossum reptans*
      5. Leaves separated by 3–7 mm along rhizome . . . . . *Elaphoglossum incognitum*

39. *Elaphoglossum auripilum* H. Christ var. *longipilosum* Atehortúa, Novon 2:369. 1992.

DISTRIBUTION.— Common throughout Isla del Coco. This variety is also found in Costa Rica.

SPECIMENS EXAMINED.— CR: *Gómez 18042*; *Lépiz 351*; FTG: *Trusty 120*; *Trusty 185*; *Trusty 264*; *Trusty 385*; *Trusty 477*; INB: *González 1196*; *González 1209*; *Lépiz 351*; *Quesada 1087*; *Quesada 1125*; *Rojas 3620*.

40. ***Elaphoglossum cocosense*** Mickel, Novon 2:372. 1992. (Fig. 6)

TYPE: *Pittier 12359* (holotype: US).

Epiphytic; rhizome ca. 5 mm diameter, compact; rhizome scales 7–12 mm long, linear-lanceolate, orange-tan to blackish, thin, margin with sparse, very long (to 1 mm long) hair-teeth; leaves 37–65 cm long, approximate; phyllopodia present; petiole 1/10–1/5 the sterile leaf length, orange-tan, densely covered with orange-tan scales 4–8 mm long, sparsely long-hair-toothed; sterile lamina 36–50 cm long, (2.4) 3.0–4.0 cm wide, narrowly oblanceolate, chartaceous, base gradually long-attenuate, apex cuspidate; veins obscure, ca. 1 mm apart, at ca. 70° angle to costa; hydathodes lack-

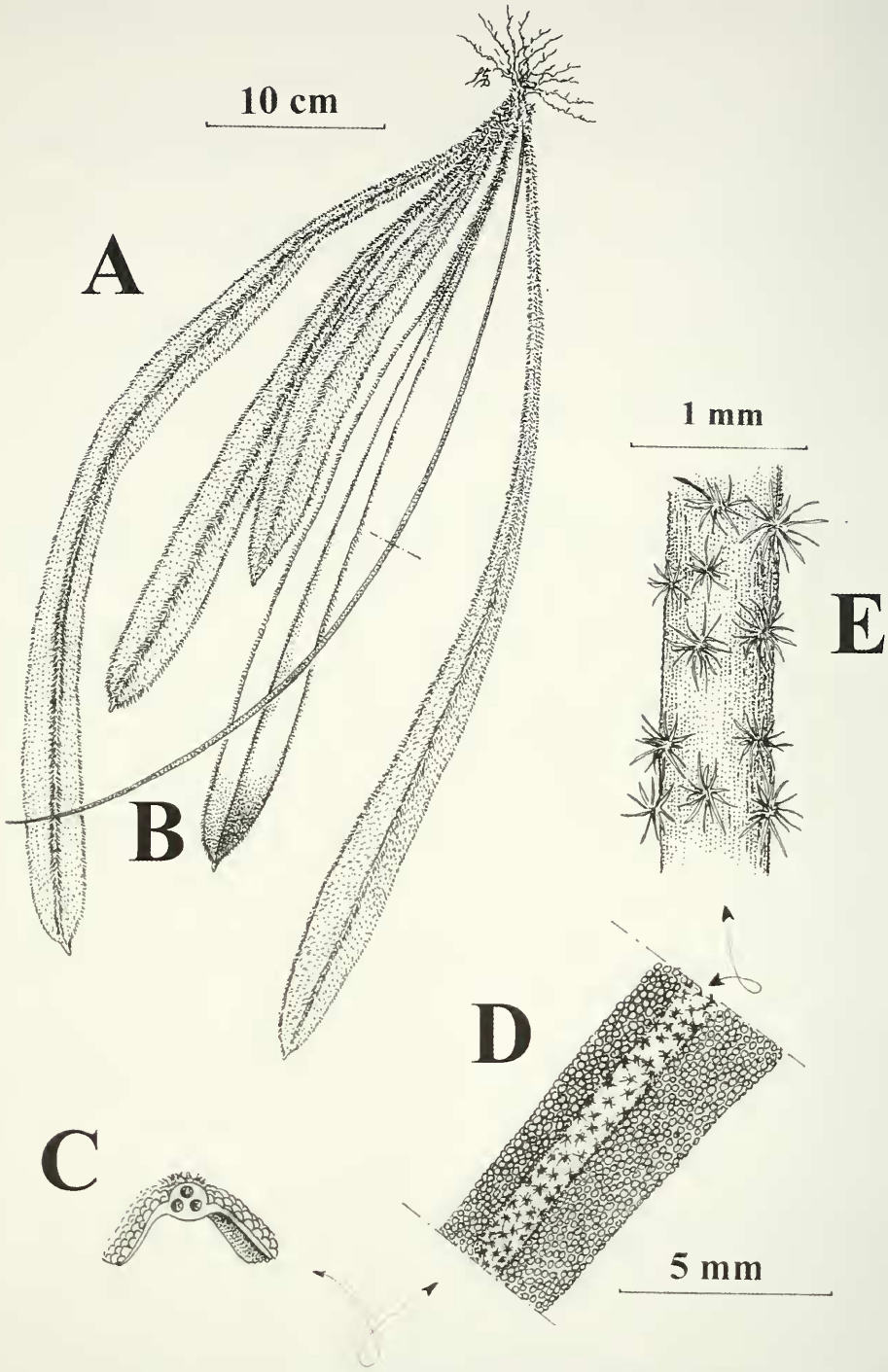

FIGURE 6. *Elaphoglossum cocosensis* (drawn from *Trusty 67*). A. Habit of plant showing sterile and fertile fronds. B. Fertile frond. C. Cross-section of fertile frond showing vein traces. D. Abaxial view of a portion of a fertile frond showing midvein. E. Close up of midvein showing stellate hairs.

ing; lamina scales abaxially 3–6 mm long, abundant, imbricate, linear-lanceolate, long hair-toothed, adaxially mostly 2–3 mm long, to glabrescent; fertile frond much longer and thinner than sterile fronds, 37–45 cm × 3–7 mm, petiole 5–8.5 cm long, equal or longer than those of sterile fronds, fertile lamina linear, the base long attenuate, the apex acuminate, scales of the costa and abaxial side of lamina small, brown, ciliate, 0.2–0.4 mm long, intersporangial scales absent.

DISTRIBUTION.— Frequent in the closed canopy forest from 200–630 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 3327*; *Gómez 3362*; *Gómez 4502*; *Rojas 3580*; *Rojas 3642*; *Soto s.n.*; *Valerio s.n.*; FTG: *Trusty 67*; *Trusty 109*; *Trusty 535*; INB: *Rojas 3580*; *Rojas 3642*; NY: *Gómez 3362*; *Rojas 3580*; *Rojas 3642*; USJ: *Soto s.n.*

41. *Elaphoglossum crinitum* (L.) H. Christ, Nue Denkschr. Allg. Schweiz. Ges. Gesammten Naturwiss. 36(1):102. 1899.

DISTRIBUTION.— Frequent in the closed canopy forest from 200–630 msl on Isla del Coco. Distributed from Mesoamerica to Venezuela and Guiana; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Gómez 4508*; *Lépiz 343*; *Quesada 1001*; *Rojas 3608*; FTG: *Trusty 386*; *Trusty 513*; *Trusty 70*; INB: *Lépiz 343*; *Quesada 1001*; *Rojas 3608*.

42. *Elaphoglossum decoratum* (Kunze) T. Moore, Index Fil. 8. 1857.

DISTRIBUTION.— Rare; in the cloud forest above 400 msl of Isla del Coco. Distributed from Mesoamerica to Peru and Bolivia; also found in the Antilles.

SPECIMENS EXAMINED.— CR: *Quesada 1002*; FTG: *Trusty 281*; *Trusty 374*; INB: *Quesada 1002*; *Rojas 3609*.

43. ***Elaphoglossum incognitum*** A. Rojas, Rev. Biol. Trop. 51:7. 2004.

TYPE: *Rojas 3613* (holotype: INB; isotypes: CR, MO, NY, UC, US).

Epiphytic or terrestrial; rhizomes 3–5 mm diameter, short-creeping; rhizome scales 7–12 × 0.8–1.0 mm, linear-lanceolate, orange-yellowish, marginally entire to occasionally long ciliate; phyllopodia present, 10–15 mm long; fronds 27–43 cm long, 2–7 mm wide, stipes 1/10–1/5 (1/4) of frond length; stipe scales 3–7 × 0.7–1.0 mm, ovate lanceolate to linear-lanceolate, orange-yellowish, marginally long-ciliate; blade scales 0.1–0.3 mm wide, stellate, orange-yellowish, dispersed, marginally long-ciliate; present only on abaxial surface; veins evident, 1–2-forked, 1.0–1.5 mm apart, diverging at 75–85° from costa; hydathodes absent; fertile fronds smaller than sterile, petiole 7–10 cm long, equal or longer than those of sterile fronds, petiole scales sparse, linear 3–5 mm long, lamina linear-lanceolate, base attenuate, apex acuminate, completely glabrous, intersporangial scales absent.

DISTRIBUTION.— Frequent in closed canopy forest from 100–300 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 139*; *Trusty 295*; *Trusty 324*; *Trusty 462*; *Trusty 463*.

44. ***Elaphoglossum reptans*** A. Rojas, Rev. Biol. Trop. 51:13. 2004.

TYPE: *Rojas 3621* (holotype: INB; isotypes: CR, F, K, MEXU, MO, NY, UC, US).

Terrestrial, rhizomes 1.5–2.0 mm diameter, long-creeping; rhizome scales 1–1.5 × 0.3–0.6 mm, ovate to ovate-lanceolate, blackish, deciduous, marginally entire to denticulate; phyllpodia present, 15–30 mm wide; fronds 23–27 cm long, 20–30 mm wide; stipes ca. 1/3 of frond length; basal stipe scales 2–3.5 × 0.4–0.8 mm, linear-lanceolate, brown with paler margin, marginally entire to denticulate, dense; medial stipe scales 3–5 × 1.0–1.5 mm, lanceolate, bicolorous with brown central line and yellowish to pale brown margin, dispersed, marginally entire to dentate; blades 16–18 × 5–6.5 cm, ovate to elliptic-lanceolate, coriaceous, basally cuneate, apically obtuse to rounded; blade

scales 0.1–0.3 mm wide, stellate, orange-yellowish, dispersed, marginally long-ciliate, present only on abaxial surface; veins evident, simple to 1-forked, 1.0–1.5 mm apart, diverging at 70–85° from costa; hydathodes absent; fertile fronds 22.5 cm long; stipes ca. ½ of frond length; fertile blades 1–.5 × 2.6 cm, elliptic-lanceolate, basally obtuse, apically obtuse; intersporangial scales absent.

DISTRIBUTION.— Infrequent but locally common in cloud forest above 400 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 117*; *Trusty 273*; *Trusty 383*; *Trusty 558*; INB: *Quesada 1009*.

LYCOPODIACEAE

1. Plants terrestrial . . . . . *Lycopodium cernuum*
1. Plants epiphytic 2
   2. Plants delicate; longest leaves less than 7 mm, acicular, less than 0.7 mm wide; stems generally less than 1 mm wide at the base (excluding the leaves) . . . . . *Huperzia brachiata*
   2. Plants robust; leaves of the basal divisions longer than 8 mm; leaves 1–5 mm wide, linear subulate to lanceolate; stems 0.3–5 mm wide . . . . . *Huperzia pittieri*

45. ***Huperzia brachiata*** (Maxon) Holub, Folia Geobot. Phytotax. 20:71. 1985.

TYPE: *Agassiz s.n.* (holotype: US!).

Pendent epiphyte, 15–40 cm long, 3 to 5 times dichotomous, the branches 6–9 mm wide (including the leaves) spreading, widely divaricate (60°–90°), the tips (if fertile) almost continuously sporangiate for a distance of 2–6 cm. Stems very slender, 0.5 mm in diameter, wholly concealed by the appressed imbricate bases of the very numerous closely set leaves; leaves 5–6 × 0.3–0.5 mm, in 4 (5) ranks, not twisted at the base, all alike slightly ascending, somewhat secund, membranous, 5–6 mm long, acicular to linear-subulate from a linear-lanceolate base ca. 0.5 mm wide, subcapillary at the tips, entire, the upper surface usually somewhate concave in drying, often deeply so near the base, the basal portion of the leaf sometimes plicate, the apical portion often irregularly tortuous; costa percurrent, relatively prominent, readily visible by transmitted light, distinctly elevated below, the base of the leaf strongly carinate; sporophylls scarce, like the sterile leaves, not reduced in size; sporangia reniform to obtusely cordate-reniform, ca. 0.8 mm broad, the sinus very deep.

DISTRIBUTION.— Rare; in closed canopy forest. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 6558*; *Gómez 6560*; *Rojas 3720*; INB: *Rojas 3720*; US: *Agassiz s.n.*

46. ***Huperzia pittieri*** (H. Christ) Holub, Folia Geobot. Phytotax. 20:76. 1985. (Fig. 7)

TYPE: *Pittier 12357* (holotype: US!).

Epiphyte; plants up to 60 cm long, flaccidly pendulous, sparsely ramified; branches 10–20 mm wide (including the leaves), nearly the same width throughout the plant, often scarcely attenuate, homophyllous or nearly homophyllous; stems ca. 1 mm wide (excluding the leaves); leaves 10–15 × 1–1.5 mm, in irregular verticillations alternating 3 or 4, linear-lanceolate to linear, spreading to ascendent, the base generally torcid, the apex prolongedly filiform; leaves of the distal portions equal or shorter; nerves slender, sporangia ca. 1 mm wide, yellow.

DISTRIBUTION.— Frequent in the closed canopy forest above 200 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Dauphin 1088*; *Dressler 4457*; *Gómez 6564*; *Gómez 6931*; *Gómez 6945*; *Gómez 18047*; *Klawe s.n.*; *Rojas 3618*; *Sánchez 9*; *Valerio 1592*; *Valerio 2227*; *Valerio 31048*; *Valerio 31049*; FTG: *Trusty 102*; *Trusty 142*; *Trusty 181*; *Trusty 182*; *Trusty 245*;

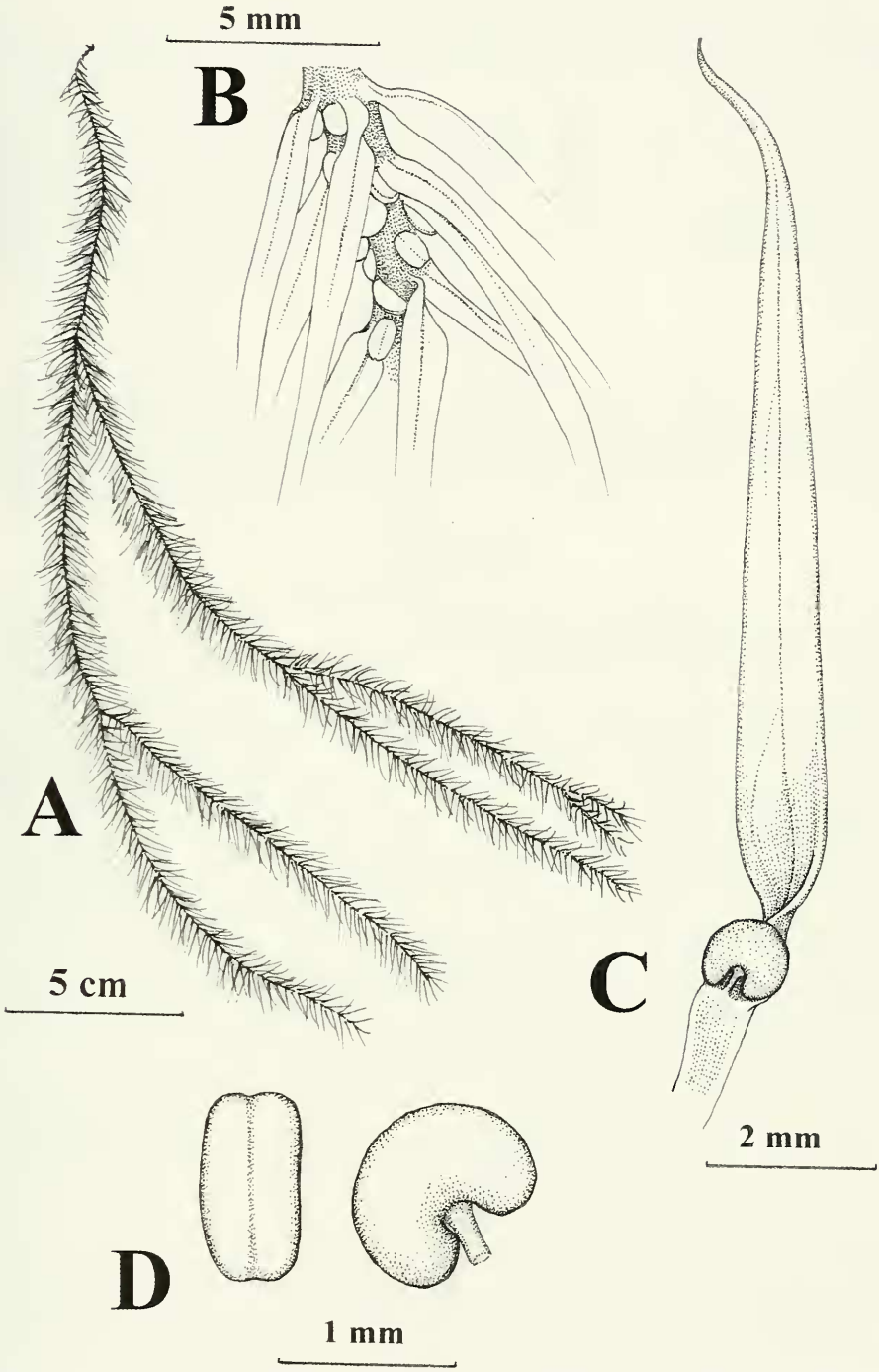

FIGURE 7. *Huperzia pittieri* (drawn from *Trusty 245*). A. Habit of plant showing bifurcating stems. B. Close up of fertile portion of stem showing sporophylls and sporangia. C. Close up of sporophyll and associated sporangium. D. Ventral and lateral view of sporangium.

Trusty 460; *Trusty 480*; *Trusty 498*; *Trusty 545*; GH: *Holdridge 5144*; *Holdridge 5154*; *Howell 10179*; *Snodgrass and Heller 971*; *Svenson 324*; INB: *Rojas 3618*; US: *Barclay 2211*; *Pittier 12357*; *Svenson s.n.*; *Valerio 1592*; *Valerio 2227*.

47. *Lycopodiella cernua* (L.) Pic. Serm., Webbia 23:166. 1968.

DISTRIBUTION.— Locally common in the cloud forest above 350 msl on Isla del Coco. Distributed from the United States to Peru, Brazil and Paraguay; also found in the Antilles, Trinidad and the Old World tropics.

SPECIMENS EXAMINED.— FTG: *Trusty 58*; INB: *González 1176*; *Lépiz 334*; *Quesada 1074*; *Rojas 3626*.

MARATTIACEAE

48. *Danaea nodosa* (L.) Sm., Mém. Acad. Roy. Sci. (Turin) 5. 1790–1791.

DISTRIBUTION.— Common along river and stream edges throughout Isla del Coco. Distributed from southern Mexico to Peru and southern Brazil; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— FTG: *Trusty 165*; *Trusty 475*; INB: *Rojas 3644*; USJ: *Soto s.n.*

OLEANDRACEAE

1. Lamina simple, entire; petiole articulate to the phyllopodia; rhizome long creeping; sori along the medial or proximal portion of the nerves . . . . . *Oleandra articulata*
1. Lamina 1-pinnate; petiole continuous with the rhizome; rhizome short creeping; sori at the apex of the nerves 2
   2. Base of the mature petioles with adpressed dark brown scales with narrow pale margins . . . . . *Nephrolepis multiflora*
   2. Base of the mature petioles often with a few lax scales, reddish to clear brown, or without scales 3
      3. Pinnae of the distal half of the the frond equilateral . . . . . *Nephrolepis biserrata*
      3. Pinnae of the distal half of the frond not equilateral . . . . . *Nephrolepis rivularis*

49. *Nephrolepis biserrata* (Sw.) Schott, Gen. Fil. t. 3. 1834.

DISTRIBUTION.— Extremely common in full sun and disturbed areas along trails on Isla del Coco. Distributed from Florida and southern Mexico to Peru, Bolivia and southern Brazil; also found in the Antilles, Trinidad and the Old World tropics.

SPECIMENS EXAMINED.— CR: *Quesada 1093*; *Quesada 1094*; *Quesada 1112*; *Rojas 3599*; *Soto s.n.*; FTG: *Trusty 275*; *Trusty 41*; INB: *González 1145*; *González 1192*; *Quesada 1093*; *Quesada 1094*; *Quesada 1112*; *Rojas 3599*; US: *Agassiz s.n.*; *Foster 4152*; *Gómez 3352*; *Klawe 1498*; *Klawe 1555*; *Pittier 12361*; *Schmitt 133*; *Stewart 234*; *Stewart 235*; *Stewart 236*; USJ: *Soto s.n.*

50. *Nephrolepis multiflora* (Roxb.) F. M. Jarret ex C. V. Morton. Contr. U.S. Natl. Herb. 38:309. 1974.

Distribution.—Infrequent on Isla del Coco; found in Wafer Bay and along the trail from Wafer to Chatham Bay. Distributed from Florida and southern Mexico to Peru, Bolivia and Brazil; also found in the Antilles, Bahamas and the Old World tropics.

SPECIMENS EXAMINED.— CR: *Rojas 3687*; INB: *Rojas 3687*; USJ: *Soto s.n.*

51. *Nephrolepis rivularis* (Vahl) Mett. Ex Krug, Bot. Jarhrb. Syst. 24:122. 1897.

DISTRIBUTION.— Found only in the cloud forest areas above 400 msl on Isla del Coco.

Distributed from southern Mexico to Peru, Bolivia and Brazil; also found in the Antilles.

SPECIMENS EXAMINED.— CR: *Rojas 3607*; FTG: *Trusty 318*; *Trusty 366*; INB: *Rojas 3607*.

52. *Oleandra articulata* (Sw.) C. Presl, Tent. Pterid. 78. 1836.

DISTRIBUTION.— Common epiphyte from 0–400 msl on Isla del Coco. Distributed from southern Mexico to Peru, Bolivia and Brazil; also found in the Antilles.

SPECIMENS EXAMINED.— CR: *Gómez 3346*; *Holdridge 5132*; *Jiménez 3147*; *Rojas 3579*; FTG: *Trusty 45*; *Trusty 118*; *Trusty 319*; *Trusty 549*; GH: *Gómez 3346*; *Holdridge 5132*; INB: *Quesada 1003*; *Rojas 3579*; US: *Foster 4154*; *Jiménez 3147*; *Schmitt 132*; *Stewart 239*; USJ: *Soto s.n.*

OPHIOGLOSSACEAE

53. *Cheiroglossa palmata* (L.) C. Presl, Suppl. Tent. Pterid. 57. 1845.

DISTRIBUTION.— Rare; found in closed canopy forest above 200 msl on Isla del Coco. Distributed from Florida and southern Mexico to Peru, Boliva and Brazil; also found in the Antilles, Cuba, Vietnam, the Democratic Republic of the Congo, Madagascar, Réunion and the Seychelles.

SPECIMENS EXAMINED.— FTG: *Trusty 216*.

POLYPODIACEAE

1. Lamina simple, entire 2
    2. Fronds 25–140 cm long . . . . . *Campyloneurum phyllitidis*
    2. Fronds 6–20 cm long 3
        3. Scales of the rhizome clathrate . . . . . *Pleopeltis astrolepis*
        3. Scales of the rhizome not clathrate . . . . . *Microgramma nitida*
1. Lamina pinnatisect to 3-pinnate 4
    4. Laminar tissue scaley abaxially . . . . . *Polypodium dissimile*
    4. Laminar tissue without scales abaxially . . . . . *Phlebodium pseudoaureum*

54. *Campyloneurum phyllitidis* (L.) C. Presl, Tent. Pterid. 190. 1836.

DISTRIBUTION.— Common throughout Isla del Coco. Distributed from southern Florida and Mexico to Argentina; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— FTG: *Trusty 48*; *Trusty 441*; *Trusty 565*; GH: *Svenson 311*; INB: *González 1148*; *González 1193*; *Rojas 3597*; USJ: *Soto s.n.*

55. *Microgramma nitida* (J. Sm. & Hook.) A. R. Sm., Proc. Calif. Acad. Sci. ser. 4, 40:230. 1975.

DISTRIBUTION.— Rare on Isla del Coco; only one location known near the ranger station in Chatham Bay. Distributed from Mexico to Panama; also found in Jamaica and Barbados.

SPECIMENS EXAMINED.— FTG: *Trusty 443*.

56. *Phlebodium pseudoaureum* (Cav.) Lellinger, Amer. Fern J. 77:101. 1987.

DISTRIBUTION.— Common throughout Isla del Coco from 0–400 msl. Distributed from Florida and Mexico to Argentina; also found in the Antilles.

SPECIMENS EXAMINED.— CR: *Gómez 3355*; *Lépiz 342*; FTG: *Trusty 121*; *Trusty 532*; GH: *Holdridge 5157*; *Pittier 16236*; *Snodgrass and Heller 969*; INB: *Lépiz 342*; *Quesada 1004*; *Rojas 3595*; US: *Holdridge 5157*; *Pittier 16236*; *Snodgrass and Heller 969*; USJ: *Soto s.n.*

57. *Pleopeltis astrolepis* (Liebm.) E. Fourn., Mexic. Pl. 1:87. 1872.

DISTRIBUTION.— Infrequent on Isla del Coco; usually found growing together with bryophyte species. Distributed from southern Mexico to Peru, Bolivia and Brazil; also found in the Antilles.

SPECIMENS EXAMINED.— FTG: *Trusty 145*; *Trusty 170*; GH: *Snodgrass and Heller 958*; *Svenson 321*; INB: *Rojas 3665*; *Rojas 3780*; US: *Agassiz s.n.*; *Gómez 3363*; *Svenson 321*.

58. *Polypodium dissimile* L., Syst. Nat. ed. 10, 2:1325. 1759.

DISTRIBUTION.— Frequent at mid elevations (200–400 msl) on Isla del Coco. Distributed from southern Mexico to Venezuela and Ecuador; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Gómez 3341*; *Gómez 3364*; *Gómez 18044*; *Lépiz 353*; FTG: *Trusty 127*; *Trusty 136*; *Trusty 497*; INB: *Lépiz 353*; *Rojas 3614*.

PSILOTACEAE

59. *Psilotum nudum* (L.) P. Beauv., Podr. Aethéogam. 106, 112. 1805.

DISTRIBUTION.— Rare on Isla del Coco; found near the ranger station in Wafer Bay. Distributed from the southern United States and Mexico to Argentina; also found in the Antilles and the Old World tropics and subtropics.

SPECIMENS EXAMINED.— CR: *Dauphin 1180*; *Rojas 3596*; FTG: *Trusty 76*; INB: *Dauphin 1180*; *Quesada 1024*; *Rojas 3596*; USJ: *Dauphin 1180*.

PTERIDACEAE

1. Margins of the fertile segments not recurved, generally herbaceous like the rest of the lamina, sori acrostichoid 2
   2. Nerves free . . . . . *Acrostichum aureum*
   2. Nerves areolate . . . . . *Pityrogramma calomelanos*
1. Margins of the fertile segments recurved, generally scarious, sori not acrostichoid 3
   3. Sportangia above the reflexed margins of the lamina (false indusium); petiole black to brown, generally shiny, terete . . . . . *Adiantum latifolium*
   3. Sporangia under the reflexed margins on the lamina, petiole variously colored, shiny or opaque, terete or sulcate 4
      4. Basal pinnae 1-pinnate pinnatifid past the basal acroscopic pinnula . . *Pteris tripartita*
      4. Basal pinnae pinnatifid past the basal basiscopic pinnula . . . . . *Pteris biaurita*

60. *Acrostichum aureum* L., Sp. Pl. 1069. 1753.

DISTRIBUTION.— Common along the coasts of Isla del Coco. Distributed from southern Florida and Mexico to Ecuador, Brazil and Paraguay; also found in the Antilles, Trinidad and the Old World tropics.

SPECIMENS EXAMINED.— FTG: *Trusty 125*; INB: *González 1195*; *Rojas 3652*.

61. *Adiantum latifolium* Lam., Encycl. 1:43. 1783.

DISTRIBUTION.— Infrequent; found in closed canopy forest of Isla del Coco from 0–250 msl. Distributed from Mexico to Peru, Brazil and Paraguay; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— BKL: *Stewart 226*; CR: *González 1202*; FTG: *Trusty 40*; INB: *González 1202*; *Lépiz 371*; *Quesada 1104*; *Rojas 3582*.

62. *Pityrogramma calomelanos* (L.) Link, Handbuch 3:20. 1833.

DISTRIBUTION.— Frequent in full sun between 0–100 msl on Isla del Coco. Distributed from

southern Florida and Mexico to Argentina; also found in the Antilles and widely introduced in the Old World tropics.

SPECIMENS EXAMINED.— FTG: *Trusty 255*; *Trusty 395*; INB: *González 1216*; *Rojas 3648*; USJ: *Soto s.n.*

63. *Pteris biaurita* L., Sp. Pl. 1076. 1753.

DISTRIBUTION.— Infrequent; found in canopy gaps or near streams 0–200 msl on Isla del Coco. Distributed from southern Mexico to Peru and southern Brazil; also found in the Antilles and the Old World tropics.

SPECIMENS EXAMINED.— FTG: *Trusty 159*; *Trusty 337*; INB: *Quesada 1097*; *Rojas 3594*; US: *Jiménez 3175*; *Klawe 1542*.

64. *Pteris tripartita* Sw., J. Bot. (Schrader) 1800(2):67. 1801.

DISTRIBUTION.— Rare on Isla del Coco; collected along the trail from Wafer Bay to Cerro Iglesias. Distributed from Costa Rica to Peru and the Guianas; also found in the Antilles and the Old World tropics.

SPECIMENS EXAMINED.— INB: *Rojas 3645*.

SELAGINELLACEAE

1. Stems not articulate; leaves entire or merely short-toothed, not ciliate . . . . *Selaginella flagellata*
1. Stems articulate; leaves conspicuously ciliate (at least the base of the lateral leaves) . . . . . *Selaginella horizontalis*

65. *Selaginella flagellata* Spring, Bull. Acad. Roy. Sci. Bruxelles 10(1):228. 1843.

DISTRIBUTION.— Common in disturbed areas of Isla del Coco near Wafer Bay and along trails. Distributed from Mexico to Peru, Bolivia and Brazil; also found in Trinidad and Tobago.

SPECIMENS EXAMINED.— FTG: *Trusty 85*; GH: *Snodgrass and Heller 942*; INB: *Rojas 3588*.

66. Selaginella horizontalis (C. Presl) Spring, Bull. Acad. Roy. Sci. Bruxelles 10(1):226. 1843.

DISTRIBUTION.— Common in disturbed areas of Isla del Coco near Wafer Bay and along trails. Distributed from Costa Rica to Peru and Venezuela.

SPECIMENS EXAMINED.— FTG: *Trusty 169*; *Trusty 458*; INB: *Rojas 3586*; USJ: *Gómez-Laurito s.n.*; *Soto s.n.*

TECTARIACEAE

1. Nerves anastomosing 2
   2. Pinnae or lobes pinnatifid or pinnate for the majority of their length. . . . *Tectaria mexicana*
   2. Pinnae or lobes entire or undulate for the majority of their length. . . . . *Tectaria incisa*
1. Nerves free 3
   3. Trichomes of the adaxial face of the rachis, costae and costulae generally more than 0.5 mm. whitish, with acute apices . . . . . *Megalastrum subincisum*
   3. Trichomes of the adaxial face of the rachis, costae and costulae generally less then 0.5 mm, reddish, with obtuse apices. . . . . *Ctenitis sloanei*

67. *Ctenitis sloanei* (Poepp. ex Spreng.) C.V. Morton, Amer. Fern J. 59:66. 1969.

DISTRIBUTION.— Infrequent on Isla del Coco; collected along the trail from Wafer Bay to Cerro Iglesias. Distributed from Florida and southern Mexico to Peru and Venezuela; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Gómez 3356*; *Gómez 3360*; *Gómez 4516*; *Rojas 3646*; INB: *Rojas 3646*.

68. *Megalastrum subincisum* (Willd.) A.R. Sm. & R.C. Moran, Amer. Fern. J. 77:129. 1987.

DISTRIBUTION.— Infrequent in closed canopy forest on Isla del Coco between 200–400 msl. Distributed from southern Mexico to Peru and Bolivia; also found in the Antilles.

SPECIMENS EXAMINED.— CR: *Rojas 3649*; FTG: *Trusty 146*; INB: *Rojas 3649*.

69. *Tectaria incisa* Cav., Descr. Pl. 249. 1802.

DISTRIBUTION.— Infrequent; found in open areas from 0–150 msl on Isla del Coco. Distributed from southern Florida and southern Mexico to northern Argentina; also found in the Antilles.

SPECIMENS EXAMINED.— CR: *Holdridge 5156*; FTG: *Trusty 256*; *Trusty 315*; INB: *González 1150*; *González 1217*; *Rojas 3647*; US: *Carrasquilla 360*; *Gómez 3358*; USJ: *Soto s.n.*

70. *Tectaria mexicana* (Fée) C. V. Morton, Amer. Fern J. 56:133. 1966.

DISTRIBUTION.— Rare; found near the Genio River in Wafer Bay and in Iglesias Bay on Isla del Coco. Distributed from southwestern Mexico to western Ecuador.

SPECIMENS EXAMINED.— CR: *Rojas 3782*; GH: *Gómez 3336*; *Gómez 4529*; INB: Rojas *3782*; US: *Gómez 3336*.

THELYPTERIDACEAE

1. Lamina simple to 1-pinnate pinnatifid; petiole adaxially sulcate. 2
1. Lamina 2-pinnate-pinnatifid; petiole not sulcate adaxially . . . . . *Macrothelypteris torresiana*
    2. At least some of the trichomes of the rachis and costae bifurcate. . . . . *Thelypteris calypso*
    2. All trichomes acicular, unicellular or mulitcellular, rarely absent 3
        3. Lamina pinnate, the pinnae entire or with undulate or serrate margins; nerves united, forming areolas . . . . . .*Thelypteris serrata*
        3. Lamina pinnate-pinnatifid, the pinnae generally incised half their width or more; nerves free, joining the sinus 4
            4. Lamina without proximally reduced pinnae, or if reduced pinnae present, then the nerves uniting below the sinus 5
                5. Bacilliar or squamiform aerophores present at the base of the pinnae 6
                5. Aerophores absent at the base of the pinnae . . . . . *Thelypteris hispidula*
                6. Nerves joining the margin above the sinus; nerves 25 pairs or more per segment . . . . . *Thelypteris decussata* var. *costaricensis*
                6. Nerves joining at or below the sinus, up to 22 pairs of nerves per segment . . . . . *Thelypteris leprieurii* var. *subcostalis*
            4. Lamina with one or more various pair of proximally reduced pinnae, nerves free, joining the margin above the sinus 7
                7. Laminar tissue with numerous trichomes on both surfaces. . *Thelypteris cocos*
                7. Laminar tissue glabrous . . . . . *Thelypteris balbisii*

71. *Macrothelypteris torresiana* (Gaudich.) Ching, Acta Phytotax. Sin. 8:310. 1963.

DISTRIBUTION.— Common along the beach edges on Isla del Coco. Distributed from the southeastern United States to northern Argentina; also found the Antilles, Asia, Africa and the Pacific Islands.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 262*; *Trusty 298*.

72. *Thelypteris balbisii* (Spreng.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10:250. 1941.

DISTRIBUTION.— Infrequently found in closed forest throughout Isla del Coco. Distributed from Mexico to Panama; also found in the West Indies.

SPECIMENS EXAMINED.— CR: *Gómez 18072*; FTG: *Trusty 240*; *Trusty 402*; US: *Gómez 3359*; *Klawe 1506*.

73. ***Thelypteris calypso*** L. D. Gómez, Brenesia 8:98. 1976.

TYPE: *Gómez 4534* (holotype: UC; isotype: CR!).

Rhizome suberect; leaves 40–50 cm; petiole 15–25 cm × 2–3 mm; lamina 20–25 cm, the apex confluent and pinnatifid; bulbils with small plants in the axils of the distal pinnae; pinnae 8–12 pairs, up to 10 × 2.3 cm, incised ca. 3/4 of their width; segments 3–4 mm wide, rounded at the apex; nerves 7–9 pairs per segment, the proximal pair of adjacent segments connecting at the margin of the sinus; indumentum of the underside of trichomes, 0.1–0.2 mm long, bifurcate, stipitate, stellate, above the axils and the nerves, also with trichomes up to 0.5 mm, acicular, dispersed, the margins of the segments with trichomes 0.3–0.4 mm, acicular, simple, the laminar tissue without trichomes, frequently ferruginous; indumentum of the back absent, the laminar tissue glabrous; sori indusiate; indusium persistent, with trichomes 0.2–0.2 mm, bifurcate; sporangia glabrous.

DISTRIBUTION.— Infrequent in open areas and trail edges from 0–100 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 4534*; FTG: *Trusty 193*.

74. ***Thelypteris cocos*** A.R. Sm. & Lellinger, Proc. Biol. Soc. Wash. 98:918. 1985. (Fig. 8)

TYPE: Klawe *1480a* (holotype: US).

Rhizome suberect, the caudex 1.5–2 cm diameter; leaves 20–60 cm; petiole up to 4 cm × 2–3 mm, proximally with sparse ciliate or glabrous scales, brown; lamina up to 55 cm, proximally with 5–10 pairs of gradually reduced pinnae, the inferior pairs 2–5 mm, ariculiform; pinnae up to 30 pairs, up to 7 x1.4 cm, the majority opposite or subopposite, incised up to 1 mm from the costa; aerophores absent; segments 2–3 mm wide; nerves 5–9 pairs per segment; indumentum of the back of trichomes 0.2–1 mm, dense, also of the rachis and costa, the laminar tissue with numerous trichomes 0.1–0.2 mm on both surfaces, also with sessile orange glands on the back; sori indusiate; indusium 0.2–0.4 mm diameter, persistent, with trichomes ca. 0.2 mm and some with sessile glands.

DISTRIBUTION.— Common throughout the island from 0–400 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 18089*; *Gómez s.n.*; *González 1199*; FTG: *Trusty 46*; *Trusty 303*; *Trusty 347*; *Trusty 375*; *Trusty 392*; *Trusty 530*; *Trusty 559*; INB: *González 1199*; *Rojas 3593*; *Rojas 3681*; US: *Fisher s.n.*

75. *Thelypteris decussata* (L.) Proctor var. *costaricensis* A.R. Sm., Univ. Calif. Publ. Bot. 76:16. 1980.

DISTRIBUTION.— Extremely common in closed canopy forest of Isla del Coco from 0–400 msl. This variety is also found in Costa Rica.

SPECIMENS EXAMINED.— CR: *Foster 4158*; *Foster 4158*; *Gómez 4513*; *Gómez 18092*; *Holdridge 5149*; *Rojas 3577*; *Soto s.n.*; *Valerio 38490*; FTG: *Trusty 98*; *Trusty 320*; INB: *González 1189*; *Rojas 3577*; US: *Klawe s.n.*; *Stewart 232*; USJ: *Soto s.n.*

76. *Thelypteris hispidula* (Decne.) C.F. Reed, Phytologia 17:283. 1968.

DISTRIBUTION.— Frequent along trail between Chatham and Wafer Bays of Isla del Coco. Distributed from the southeastern United States to northern Argentina; also found in the Antilles and the Old World tropics and subtropics.

SPECIMENS EXAMINED.— CR: *Gómez 3350; Gómez 4533*; *Gómez 4538*; *Gómez 4539*; *Gómez*

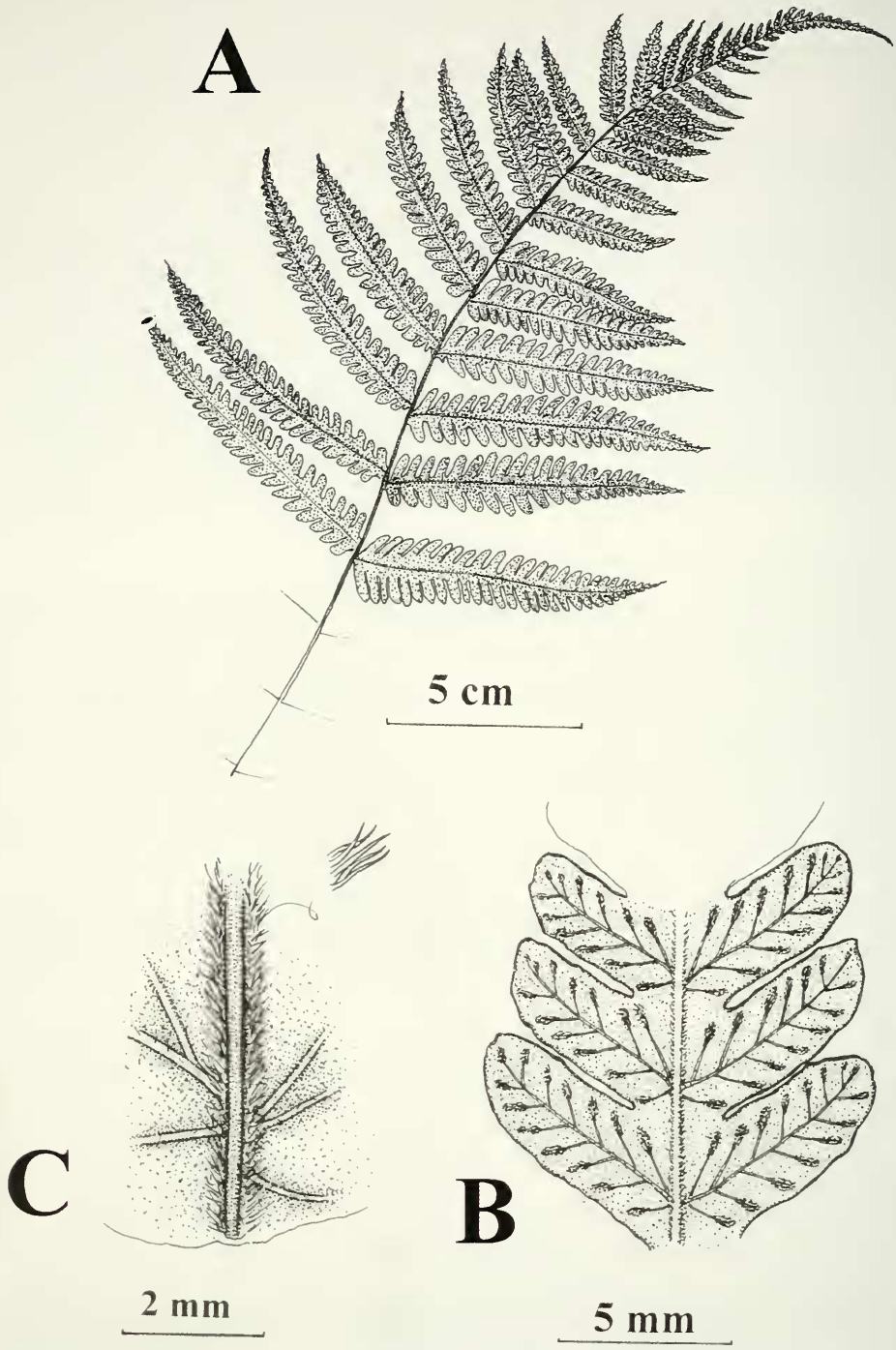

FIGURE 8. *Thelypteris cocos* (drawn from *Trusty 347*). A. Terminal section of frond. B. Close up of pinna showing immature sori. C. Close up of pinna venation showing dense hairs.

18096; *Gómez 18097*; *Klawe s.n.*; *Rojas 3583*; FTG: *Trusty 49*; *Trusty 258*; *Trusty 308*; *Trusty 524*; *Trusty 554*; INB: *Rojas 3583*; US: *Gómez 3361*.

77. *Thelypteris leprieurii* (Hook.) R.M. Tryon var. *subcostalis* A.R. Sm., Univ. Calif. Publ. Bot. 76:26. 1980.

DISTRIBUTION.— Infrequent on Isla del Coco; collected near the Genio River in Wafer Bay and along the trail between Wafer and Chatham Bays on Isla del Coco. Distributed from Guatemala and Belize to Columbia.

SPECIMENS EXAMINED.— CR: *Gómez 18053*; *González 1201*; *Rojas 3592*; INB: *González 1201*; *Rojas 3592*.

78. *Thelypteris serrata* (Cav.) Alston, Bull. Misc. Inform. Kew. 1932:309. 1932.

DISTRIBUTION.— Infrequent; found in full sun along trail edges on trail between Chatham and Wafer Bays on Isla del Coco. Distributed from Florida and southern Mexico to northern Argentina; also found in the Antilles.

SPECIMENS EXAMINED.— CR: *Jiménez 3201*; FTG: *Trusty 523*; INB: *González 1218*; *Rojas 3686*.

VITTARIACEAE

1. Leaves elliptical; sori subacrostichoid. . . . . *Anetium citrifolium*
1. Leaves linear; sori linear or elongate. . . . . *Vittaria graminifolia*

79. *Anetium citrifolium* (L.) Splitg., Tijdschr. Natuuri. Gesch. Physiol. 7:395. 1840.

DISTRIBUTION.— Rare on Isla del Coco, found near the waterfall in Wafer Bay. Distributed from Guatemala and Belize to Peru, Bolivia and Brazil; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED. — GH: *Gómez 3331*.

80. *Vittaria graminifolia* Kaulf., Enum. Filic. 192. 1824.

DISTRIBUTION.— Common in closed canopy forest on Isla del Coco from 0–300 msl. Distributed from Mexico to Peru, Uruguay and southern Brazil; also found in the Antilles and Trinidad.

SPECIMENS EXAMINED.— CR: *Soto s.n.; FTG: Trusty 97; Trusty 279; Trusty 489; INB: Quesada 1029; Rojas 3643; US: Foster 4118; Gómez 3342; Klawe 1479; Klawe s.n.; Svenson 330.*

WOODSIACEAE

81. *Diplazium lechleri* (Mett.) T. Moore, Index Fil. 141. 1859.

DISTRIBUTION.— Extremely common in the cloud forest above 400 msl on Isla del Coco. Distributed from Costa Rica to Peru and Brazil.

SPECIMENS EXAMINED.— FTG: *Trusty 72; INB: Lépiz 336; Quesada 1007; Rojas 3634.*

Key to the Families of Spermatophytes on Isla del Coco

1. Plants vines climbing by tendrils 2
    2. Tendrils simple . . . . . Passifloraceae
    2. Tendrils branched . . . . . Cucurbitaceae
1. Plants without tendrils. 3
    3. Plants parasitic or saprophytic 4

4. Plants attached to branches of living shrubs or trees ..... Loranthaceae
4. Plants not attached to branches of living shrubs or trees 5
5. Plants leafless, composed of a single yellow flower ..... Gentianaceae
5. Plants with bract-like leaves, composed of a panicle of cream-white flowers ..... Burmanniaceae
3. Plants not parasitic or saprophytic 6
6. Inflorescence a dense head subtended by an involucre; sepals dry scales, bristles or absent, white to brown ..... Asteraceae
6. Inflorescence various, but not an involucrate head; sepals usually green 7
7. Plants conspicuously woody; lianas, shrubs or trees 8
8. Leaves compound ..... GROUP A
8. Leaves simple 9
9. Leaves opposite ..... GROUP B
9. Leaves alternate ..... GROUP C
7. Plants herbaceous or with a slightly woody base 10
10. Plants vining ..... GROUP D
10. Plants not vining 11
11. Flowers lacking petals, or complete perianth 12
12. Flowers in compact spikes; leaves pellucid punctate .... Piperaceae
12. Flowers not in spikes, leaves without pellucid punctations 13
13. Leaves opposite ..... Euphorbiaceae (*Chamaesyce*)
13. Leaves alternate ..... Phyllanthaceae
11. Flowers with developed perianth (sepals and petals) 14
14. Leaves with parallel venation, alternate; blades often sheathing at the base ..... GROUP E
14. Leaves without parallel venation, alternate, opposite or whorled; blades not sheathing at the base ..... GROUP F

Group A: Shrubs, trees or lianas with compound leaves

1. Plants palm-like; venation parallel ..... Arecaceae
1. Plants not palm-like; venation pinnate 2
2. Ovary 1-carpellate, 1-locular; fruits samaras; stamens free ..... Fabaceae
2. Ovary with 2 or more carpels and locules, fruits capsular with 4 or more valves; attached to a gynophore ..... Meliaceae

Group B: Shrubs, trees or lianas with simple, opposite leaves

1. Plant dioecious; leaves lemon-scented ..... Chloranthaceae
1. Plants bisexual; leaves without lemon scent 2
2. Ovary inferior 3
3. Flowers with corolla tubular; interpetiolar stipules ..... Rubiaceae
3. Flowers with the petals free; stipules lacking 4
4. Leaves palmately veined, lacking pellucid punctations ..... Melastomataceae
4. Leaves pinnately veined, with pellucid punctations ..... Myrtaceae
2. Ovary superior 5
5. Petals united at least at the base; perianth differentiated into calyx and corolla 6

6. Hemiepiphytic liana; corolla actinomorphic ..... Schlegeliaceae
6. Shrub or small tree; corolla zygomorphic ..... Verbenaceae
5. Petals free or lacking 7
7. Styles or stigmas 3 or more; calyx present; colored sap present ..... Clusiaceae
7. Styles or stigmas 1; flowers lacking calyx; colored sap absent ... Rhizophoraceae

Group C: Shrubs or Trees with simple, alternate leaves

1. Branches producing aerial roots that may reach the ground to from secondary trunks; flowers borne on the inside of a globose, fleshy receptacle ..... Moraceae
1. Branches not producing aerial roots; flowers variously arranged, not inside a receptacle 2
2. Leaves not entire (toothed or lobed) 3
3. Blades lobed, not toothed 4
4. Leaf blades less than 20 cm long ..... Euphorbiaceae (Manihot, *Ricinus*)
4. Leaf blades greater than 20 cm long 5
5. Blades deeply pinnately divided ..... Arecaceae
5. Blades not pinnately divided 6
6. Flowers many, minute in axillary spikes ..... Cecropiaceae
6. Flowers solitary or multiple, not minute, cauliflorous ..... Caricaceae
3. Blades not lobed, toothed 7
7. Teeth rare, inconspicous 8
8. Ramiflorous; leaves with black punctations ..... Aquifoliaceae
8. Flowers axillary; leaves lacking black punctations ..... Theaceae
7. Teeth common, obvious 9
9. Leaves stellate pubescent 10
9. Leaves not stellate pubescent ..... Euphorbiaceae (*Acalypha*)
10. Stamens fused by their filaments; anthers free ..... Malvaceae (in part)
10. Stamens free, anthers free ..... Muntingiaceae
2. Leaves entire 11
11. Colored sap present; red peltate scales on leaf undersurface ..... Bixaceae
11. Colored sap not present; red peltate scales lacking on leaves 12
12. Venation parallel; conspicuous colored bracts subtending the flowers . . Musaceae
12. Venation pinnate; lacking colored bracts 13
13. Ovary inferior ..... Combretaceae
13. Ovary superior 14
14. Leaves with punctations 15
15. Plants with spines; petiole winged ..... Rutaceae
15. Plants lacking spines; petiole not winged ..... Myrsinaceae
14. Leaves lacking punctations 16
16. Anthers opening by valves ..... Lauraceae
16. Anthers not opening by valves 17
17. Flowers with a single fertile stamen ..... Anacardiaceae
17. Flowers with more than one fertile stamen 18
18. Fruits single seeded ..... Chrysobalanaceae
18. Fruits with more than one seed 19
19. Fruit aggregate ..... Annonaceae
19. Fruit simple 20

20. Canopy tree; venation brochididromous ..... Humiriaceae
20. Shrub; venation palmate at the base ..... Malvaceae (*Theobroma*)

Group D: Herbaceous vines

1. Leaves compound ..... Fabaceae
1. Leaves simple 2
  2. Plants with copious milky sap ..... Apocynaceae (*Tassadia*)
  2. Plants without milky sap 3
    3. Venation parallel ..... Araceae
    3. Venation pinnate or palmate, not parallel 4
      4. Inflorescence umbelliform; corolla zygomorphic ..... Marcgraviaceae
      4. Inflorescence of single or multiple flowers, not umbelliform; corolla radial ..... Convolvulaceae

Group E: Herbs; Monocotyledons

1. Flowers inconspicuous, less than 1cm 2
  2. Flowers without sepals or petals 3
    3. Leaves two-ranked ..... Poaceae
    3. Leaves three-ranked ..... Cyperaceae
  2. Flowers with sepals and petals ..... Araceae (*Spathiphyllum*)
1. Flowers conspicuous; greater than 1 cm 4
  4. Leaves basal forming a tank-like rosette; flowers hidden between old leaf bases ..... Bromeliaceae
  4. Leaves cauline not forming a tank; flowers not hidden 5
    5. Plants epiphytic ..... Orchidaceae
    5. Plants terrestrial 6
      6. Stem decumbent, creeping ..... Commelinaceae
      6. Stem erect ..... Musaceae

Group F: Herbs; Dicotyledons

1. Leaves trifoliolate ..... Fabaceae
1. Leaves simple 2
  2. Flowers unisexual ..... Urticaceae
  2. Flowers bisexual 3
    3. Leaves alternate 4
    3. Leaves opposite 5
      4. Petals free 6
      4. Petals fused 7
        5. Milky sap present ..... Apocynaceae (*Catharanthus*)
        5. Milky sap absent 8
          6. Flowers in heads or umbels; petals white ..... Apiaceae
          6. Flowers solitary, not in heads or umbels; petals yellow ..... Onagraceae
            7. Stamens more than 10, fused by the filaments ..... Malvaceae
            7. Stamens 5, free ..... Solanaceae

8. Leaves peltate . . . . . Caryophyllaceae
8. Leaves not peltate 9
9. Stipule present, interpetiolar . . . . . Rubiaceae
9. Stipule present or absent; not interpetiolar 10
10. Inflorescence a raceme, fruits purple berries . . . . . Phytolaccaceae
10. Inflorescence not a raceme, solitary or in compact heads, fruits otherwise 11
11. Plants aromatic; fruit a 4-seeded nutlet . . . . . Lamiaceae
11. Plants not aromatic; fruit a capsule 12
12. Corolla red; anthers fused . . . . . Gesneriaceae
12. Corolla white; anthers free 13
13. Corolla 5-parted . . . . . Scrophulariaceae
13. Corolla 4-parted 14
14. Winged hypanthium present . . . . . Melastomataceae (*Schwackaea*)
14. Winged hypanthium absent . . . . . Plantaginaceae

Anacardiaceae

1. Blades acute or acuminate at the apex . . . . . *Mangifera indica*
1. Blades blades obtuse to rounded at the apex . . . . . *Campnosperma panamense*

82. *Campnosperma panamense* Standl., J. Arnold Arbor. 2:111–112. 1920.

Distribution.— Rare on Isla del Coco; collected between Iglesias Bay and Cerro Tesoro Escondido. Distributed from Honduras to Colombia and coastal Ecuador.

Remarks.— First report for Isla del Coco.

Specimens examined.— INB: *Quesada 1127*.

83. **Mangifera indica* L., Sp. Pl. 200. 1753.

Distribution.— Cultivated on Isla del Coco near the Wafer Bay ranger station. This species is native to Asia and is cultivated throughout the tropics.

Remarks.— The trees appear to be young and did not have flowers or fruit during any of our research trips to the island.

Specimens examined.— CR: *Quesada 1105*.

Annonaceae

1. Leaves densely pubescent beneath . . . . . *Annona cherimola*
1. Leaves glabrous . . . . . *Annona glabra*

84. **Annona cherimola* Mill., Gard. Dict. ed. 8. no. 5. 1768.

Distribution.— Cultivated on Isla del Coco in Wafer Bay. Stewart (1912) states that these trees are "in gardens and probably introduced". Distributed throughout Mesoamerica to Peru and Bolivia; also cultivated widely in the New World.

Remarks.— This species was reported by Stewart (1912) but no collections were located.

Specimens examined.— No collections located.

85. *Annona glabra* L., Sp. Pl. 537. 1753.

Distribution.— Found throughout Isla del Coco near the shoreline from 0–200m. Distributed

from Mexico to Ecuador and Brazil; also found in the West Indies and western Africa.

REMARKS.— Sierra (2001a) found that this was one of most commonly eaten fruits by the feral pigs on the island.

SPECIMENS EXAMINED.— CR: *Dauphin 1053*; *Gómez-Laurito 6913*; *Lépiz 365*; *Quesada 1021*; FTG: *Trusty 35*; GH: *Jiménez s.n.*; INB: *González 1168*; *Lépiz 365*; *Quesada 1021*; *Rojas 3683*; USJ: *Soto 3854*.

APIACEAE

1. Leaves orbicular, peltate. . . . . *Hydrocotyle umbellata*
1. Leaves elliptical, not peltate. . . . . *Eryngium foetidum*

86. **Eryngium foetidum* L., Sp. Pl. 232. 1753.

DISTRIBUTION.— Cultivated on Isla del Coco near the Wafer Bay ranger station. This species is commonly cultivated throughout the tropics of the New World and has been introduced into tropical Africa.

REMARKS.— The plants have not escaped from cultivation but these should be monitored as *E. foeditum* is found in clearings and weedy places in Panama (Croat 1978). First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 201*.

87. **Hydrocotyle umbellata* L., Sp. Pl. 234. 1753.

DISTRIBUTION.— Forms mats in the cleared areas near the shore in Wafer Bay. Native to the tropical areas of the New World and has been introduced into tropical southern Africa.

REMARKS.— This is probably a very recent introduction by humans to Isla del Coco due to its recent collection by us and the restricted distribution on the island near human settlements. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 210*; INB: *Rojas 3710*.

APOCYNACEAE

1. Cultivated herb; flowers pink or white . . . . . *Catharanthus roseus*
1. Forest vine; flowers white. . . . . *Tassadia obovata*

88. **Catharanthus roseus* (L.) G. Don, Gen. Hist. Dichl. Pl. 4:95. 1837 (1838).

DISTRIBUTION.— Cultivated on Isla del Coco near the Wafer Bay ranger station. Native to Madagascar but cultivated and escaped throughout the tropics.

REMARKS.— This species is an invasive exotic in many island ecosystems (Swarbrick 1997, Space et al. 2003), and we recommend its removal.

SPECIMENS EXAMINED.— FTG: *Trusty 198*.

89. *Tassadia obovata* Decne., Prodr. 8:579–580. 1844.

DISTRIBUTION.— Common in the closed forest throughout Isla del Coco from 50–450 msl. Distributed from Mexico south to Ecuador and the Guianas; including Trinidad.

REMARKS.— Although the plants are common in the understory of the forest, they do not appear to flower and fruit until they reach the canopy or a light gap is formed. This species was previously published under the name *T. colubrina* Descne. in Stewart (1912).

SPECIMENS EXAMINED.— CR: *Gómez 3295*; *Quesada 1083*; FTG: *Trusty 110*; *Trusty 507*; *Trusty 551*; INB: *Quesada 1083*.

AQUIFOLIACEAE

90. *Ilex yurumanguinis* Cuatrec., Lloydia 11(3):210–212, f. 3. 1948.

DISTRIBUTION.— Infrequent throughout Isla del Coco but more common in the northern part of the island near Cabo Atrevido. Distributed from Nicaragua to Colombia and Ecuador.

REMARKS.— This plant has been confused with *Rapanea guianensis* (Myrsinaceae) when in fruit due to the presence of ramiflorous fruits and the dark pellucid dots on the leaves.

SPECIMENS EXAMINED.— CAS: *Stewart 320*; CR: *González 1187*; *Rojas 3696*; FTG: *Trusty 505*; GH: *Foster 4115*; *Foster 4156*; INB: *González 1187*; *Rojas 3696*; USJ: *Soto 3863*.

ARACEAE

1. Plants terrestrial; stems erect 2
   2. Plants cultivated; leave blades lobed . . . . . *Xanthosoma sagittifolium*
   2. Plants not cultivated; leaf blades simple and entire . . . . . *Spathiphyllum laeve*
1. Plants epiphytic or climbing; stems vining. 3
   3. Blades with without basal lobes; collecting vein present. . . . . *Anthurium scandens*
   3. Blades with prominent basal lobes; collecting vein absent . . . . . *Philodendron hederaceum*

91. *Anthurium scandens* (Aubl.) Engl. in Mart., Fl. Brasil. 3(2):78. 1878.

DISTRIBUTION.— Infrequent in the forest of Isla del Coco between 200–400 msl. This species is found from Mexico throughout Central America to the Guianas and southern Brazil; also Trinidad and the Greater Antilles.

SPECIMENS EXAMINED.— CR: *Quesada 1084*; *Rojas 3630*; FTG: *Trusty 211*; INB: *Quesada 1084*; *Rojas 3630*.

92. *Philodendron hederaceum* (Jacq.) Schott, Wiener Z. Kunst 3:780. 1829.

DISTRIBUTION.— Frequent in the forest of Isla del Coco from 200–600 msl. Found from Mexico to Colombia, Venezuela and the Guianas.

REMARKS.— This plant is extremely difficult to find in flower or fruit but is conspicuous in the Cocos Island flora and is recognized by its large leaves with cordate blades. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 148*; *Trusty 296*; INB: *Quesada 1075*; *Quesada 1126*.

93. *Spathiphyllum laeve* Engl., Bot. Jahrb. Syst. 37:120. 1905.

DISTRIBUTION.—Common near rivers and streams throughout Isla del Coco. Distributed from Nicaragua to Colombia.

REMARKS.— Previously published under the name *S. wendlandii* Schott in Stewart (1912) and *S. atrovirens* Schott in Fosberg and Klawe (1966).

SPECIMENS EXAMINED.— CR: *Dauphin 1130*; *Gómez 3286*; *Lépiz 380*; *Sánchez 18*; FTG: *Trusty 71*; *Trusty 486*; GH: *Pittier 16244*; INB: *Lépiz 352*; *Lépiz 380*; *Rojas 3632*; US: *Dressler 4465*; *Holdridge 5165*; *Lépiz 380*; *Pittier 12370*; *Pittier 16244*; *Stewart 278*.

94. **Xanthosoma sagittifolium* (L.) Schott & Endl., Melet. Bot 19. 1832.

DISTRIBUTION.— Cultivated on Isla del Coco at the Wafer Bay ranger station. Native to the American tropics but cultivated worldwide.

REMARKS.— This plant is currently being removed from the island as it is able to spread rapidly in the cleared areas. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 134*.

Arecaceae

1. Fruits up to 5 cm long, turning purple when ripe ..... *Euterpe precatoria* var. *longevaginata*
1. Fruits 20–30 cm long turning yellow when ripe ..... *Cocos nucifera*

95. *Cocos nucifera* L., Sp. Pl. 1188. 1753.

Distribution.— Frequent along the shore and cultivated near the Wafer Bay ranger station. Pantropical in cultivation and abundant in tropical coastal areas.

Remarks.— Coconuts are apparently making a come-back on Isla del Coco from the extensive harvesting that occurred in the late 1800's.

Specimens examined.— Not collected.

96. *Euterpe precatoria* Mart. var. *longevaginata* (Mart.) A.J. Hend., Palms Amazon 111. 1995. *Rooseveltia frankliniana* O.F. Cook; *E. macrospadix* Oerst.

Distribution.— Common both within the forest and along the steep areas near the coast of Isla del Coco. Distributed from Belize to Ecuador and Peru.

Remarks.— This palm species was originally described as an endemic genus named for the U. S. President Franklin D. Roosevelt (Cook 1940).

Specimens examined.— CR: *Poveda 817*; *Valerio s.n.*; FTG: *Trusty 154*; INB: *González 1173*; USJ: *Poveda 817*.

Asteraceae

1. Leaves alternate 2
    2. Leaves white tomentose below ..... *Rolandra fruticosa*
    2. Leaves not white tomentose below ..... *Pseudoelephantopus spicatus*
1. Leaves opposite 3
    3. Pappus of numerous bristles or plumose bristle-like scales 4
        4. Shrub; flowers white ..... *Clibadium acuminatum*
        4. Herb; flowers not white 5
            5. Plants with milky sap, flowers yellow ..... *Youngia japonica*
            5. No milky sap present, flowers lavender ..... *Chromolaena odorata*
    3. Pappus not as above 6
        6. Heads axillary, sessile or short-pedunculate ..... *Synedrella nodiflora*
        6. Heads terminal, the peduncles greater than 1 cm long ..... *Sphagneticola trilobata*

97. **Chromolaena odorata* (L.) King & H. Rob., Phytologia 20:204. 1970.

Distribution.— Rare on Isla del Coco; near the Chatham Bay ranger station along the trail between Chatham and Wafer Bays. This species is widespread throughout tropical, subtropical and warm temperate America.

Remarks.— This species has recently arrived to Cocos Island and is found only in one disturbed area near Chatham Bay ranger station.

Specimens examined.— FTG: *Trusty 252*.

98. *Clibadium acuminatum* Benth., Bot. Voy. Sulphur 114. 1844.

Distribution.— Rare; collected on Isla del Coco only near Wafer Bay and along the trail from Wafer to Cerro Iglesias. Distributed in Colombia and Venezuela.

Remarks.— This species was considered a common understory shrub by Stewart (1912) but is currently rare on the island. There has been only one collection of this species since the early 1900s.

This species was originally described from Isla del Coco collections and later found on the mainland.

SPECIMENS EXAMINED.— GH: *Stewart 326*; INB: *Rojas 3637*; US: *Barclay 2179*; *Hinds s.n.*

99. **Pseudoelephantopus spicatus* (Juss.) C. F. Baker, Trans. Acad. Sci. St. Louis 12:45,55. 1902.

DISTRIBUTION.— Infrequent on Isla del Coco; found in disturbed areas near the boat landing at Wafer Bay. Distributed in continental tropical America, the West Indies and introduced in Africa and eastern Asia.

REMARKS.— This is probably a very recent introduction by humans to Isla del Coco due to the recent collection by us and its restricted distribution on the island near human settlements. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 353*.

100. *Rolandra fruticosa* (L.) Kuntze, Rev. Gen. Pl. 1:360. 1891.

R. argentea Rottb.

DISTRIBUTION.— Common in disturbed areas near habitations and trails on Isla del Coco. Distributed from Honduras to the Guianas, Peru, Brazil and the West Indies.

REMARKS.— *R. fruticosa* is considered native here due to the early collections, but it may represent an introduction to the island by humans.

SPECIMENS EXAMINED.— CR: *Gómez 3265*; *Gómez s.n.*; *Gómez-Laurito 6904*; *González 1142*; *Jiménez 3151*; *Rojas 3639*; *Valerio 1098*; FTG: *Trusty 88*; *Trusty 112*; GH: *Gómez 3265*; *Howell 10167*; *Pittier 16262*; *Snodgrass and Heller 947*; *Svenson 308*; INB: *González 1142*; *Lépiz 354*; *Quesada 1098*; *Rojas 3639*; US: *Pittier 16262*; USJ: *Soto s.n.*

101. *Sphagneticola trilobata* (L.) Pruski, Mem. New York Bot. Gard. 87:114. 1996.

Wedelia trilobata (L.) Hitchc.; *W. paludosa* DC.

DISTRIBUTION.— Locally abundant near the shoreline of Isla del Coco. Distributed in Florida, Central and South America, the West Indies and West Africa.

SPECIMENS EXAMINED.— CR: *Dauphin 1132*; *Gómez 3287*; *Quesada 1065*; *Rojas 3678*; *Valerio 1111*; FTG: *Trusty 36*; *Trusty 111*; INB: *Lépiz 366*; *Quesada 1065*; *Rojas 3678*; USJ: *Soto 3856*.

102. *Synedrella nodiflora* (L.) Gaertn., Fruct. & Sem. Pl. 2:456. 1791.

DISTRIBUTION.— Common in cleared areas of Isla del Coco. *S. nodiflora* is widespread throughout the tropics.

REMARKS.— *S. nodiflora* is considered native here due to the early collections but is probably introduced to the island by humans. This species was published under the name *Blainvillea biaristata* DC. in Stewart (1912) and Fosberg and Klawe (1966).

SPECIMENS EXAMINED.— FTG: *Trusty 277*; *Trusty 354*; *Trusty 555*; GH: *Pittier 16249*; INB: *Quesada 1036*; US: *Stewart 319*; USJ: *Soto s.n.*

103. **Youngia japonica* (L.) DC., Prodr. 7:194. 1838.

DISTRIBUTION.— Common in the lawn area of the Wafer Bay ranger station on Isla del Coco. A cosmopolitan weed.

REMARKS.— This is probably a very recent introduction by humans to Isla del Coco due to the recent collection by us and restricted distribution on the island near human settlements. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 200*.

Bixaceae

104. **Bixa orellana* L., Sp. Pl. 512. 1753.

Distribution.— No longer found. Previously cultivated on Isla del Coco in Wafer Bay. Native to tropical America but cultivated throughout the tropics and subtropics.

Remarks.— Pittier (1898) cited this species for the island and it has not been collected since.

Specimens examined.— No collections located.

Bromeliaceae

1. Epiphyte; flowers sessile. . . . . *Guzmania sanguinea*
1. Terrestrial; flowers pedunculate. . . . . *Ananas comosus*

105. **Ananas comosus* (L.) Merr., Interpr. Herb. Amboin. 133. 1917.

Distribution.— Cultivated on Isla del Coco at the Chatham Bay ranger station. Native to Brazil but widely cultivated throughout the tropics.

Specimens examined.— Not collected.

106. *Guzmania sanguinea* (André) André ex Mez in C. DC., Monogr. Phan. 9:901. 1896.

Distribution.— Extremely abundant throughout Isla del Coco. Distributed from Costa Rica to Ecuador.

Remarks.— This species was published under the name *G. crateriflora* Mez & Wercklé in Svenson (1935), *Catopsis aloides* Baker in Robinson (1902) and *Tillandsia* sp. in Stewart (1912).

Specimens examined.— CR: *Gómez 3272*; *Lépiz 350*; *Lépiz 364*; *Rojas 3656*; FTG: *Trusty 128*; INB: *Lépiz 350*; *Lépiz 364*; *Quesada 1091*; *Rojas 3656*; US: *Foster 4172*; *Gómez 3272*; *Klawe 1517*; *Svenson 322*; *Svenson 436*.

Burmanniaceae

107. *Gymnosiphon panamensis* Jonker, Monogr. Burmmann. 199, f. 18. 1938.

Distribution.— Rare on Isla del Coco; found only along one section of the ridge on the research trail from Wafer Bay to Los Llanos. Distributed from Mexico to Panama.

Specimens examined.— FTG: *Trusty 212*; *Trusty 539*.

Caricaceae

108. **Carica papaya* L., Sp. Pl. 1466. 1753.

Distribution.— Cultivated on Isla del Coco at the Chatham and Wafer Bay ranger stations. Native to the American tropics but widespread in cultivation.

Remarks.— Papaya has not escaped from cultivation on Cocos Island, however, this species is considered an invasive exotic in island ecosystems (Space et al. 2000), and we recommend its removal.

Specimens examined.— Not collected.

Caryophyllaceae

109. **Drymaria cordata* (L.) Willd., Syst. Veg. 5:406. 1819.

Distribution.— Extremely common along open-canopy trails and in cleared areas on Isla del Coco. Pantropical in distribution.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 91*; *Trusty 336*; *Trusty 466*; INB: *González 1219*.

CECROPIACEAE

110. ***Cecropia pittieri*** B.L. Rob., Proc. Calif. Acad. Sci., ser. 4, 1:389. 1912. (Fig. 9)

TYPE: *Pittier 16237* (holotype: GH).

Tree; branches 3–4 cm thick, hollow with septate cavity, leaves orbicular, large, 50 cm in diameter, briefly peltate, 10-lobate, sparsely pilose above, glabrate, green, below intensely white, nerves reticulate and patently hirsute; lobes widely orbiculate, margins undulate, apex rounded or short acuminate, sinuses rounded; petioles 40 cm long, 1 cm in diameter, terete, white-arachnoid, base thickened, dingy hirsute; stipules oblong-lanceolate, acute 16 cm long, 6 cm wide, hirsute on both sides, except for glabrisculous margins, margins absolutely entire; male spathes rounded, apex longly attenuate, 14 cm long, grey pubescent on the outside, peduncle robust, 8 cm long; male spikes ca. 19, sessile, 10 × 3 cm; female spikes unknown.

DISTRIBUTION.— Common in full sun, especially in the steep cliffs of the coast from 0–300msl. Appears as a successional species. Endemic to Isla del Coco.

REMARKS.— Alfaro (1898) stated that these plants house ants of the genus *Camponotis*.

SPECIMENS EXAMINED.— CR: *Dressler 4460*; *Gómez-Laurito 6943*; *Gómez-Laurito 6943*; *Jiménez 3184*: *Poveda 810*; *Rojas 3672*; *Sánchez 20*; FTG: *Trusty 161*; *Trusty 237*; *Trusty 404*; INB: *González 1213*; *Quesada 1064*; *Rojas 3672*; NY: *Dressler 4460*; *Fournier 311*; US: *Carrasquilla 362*; *Dressler 4460*; *Fournier 311*; USJ: *Gómez-Laurito 6943*; *Poveda 810*; *Quesada 1064*.

CHLORANTHACEAE

111. *Hedyosmum racemosum* (Ruiz & Pav.) G. Don, Gen. Hist. 3:434. 1834.

DISTRIBUTION.— Frequent on Isla del Coco above 400 msl on Cerro Iglesias. Distributed from northern Colombia to to Bolivia, the Guayana highlands of Venezuela and Guiana.

REMARKS.— *Hedyosum* is a typical species of the cloud forests of the Americas. The shrinking of climatic zones found on mountainous islands allows this species, which is commonly found above 1000 msl on the continent, to survive at 400 msl. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 61*; *Trusty 276*; *Trusty 562*; INB: *Quesada 1077*; *Rojas 3625*.

CHRYSOBALANACEAE

1. Cultivated tree: leaves 10–30 cm long. . . . . *Licania platypus*
1. Shrub, not cultivated; leaves up to 8 cm long . . . . . *Chrysobalanus icaco*

112. *Chrysobalanus icaco* L., Sp. Pl. 513. 1753.

DISTRIBUTION.— Infrequent along the coast of Isla del Coco. Distributed from Florida and Mexico through Central America and the West Indies to northern South America; also in West Africa.

SPECIMENS EXAMINED.— CR: *Gómez 3275*; FTG: *Trusty 452*.

113. **Licania platypus* (Hemsl.) Fritsch, Ann. K.K. Naturhist. Hofmus. 4:53. 1889.

DISTRIBUTION.— Only one individual found on Isla del Coco near the Genio River in Wafer Bay. Distributed from southern Mexico south to Colombia.

REMARKS.— This large tree appears to be vestigial from the Gissler settlement. Rats and pigs

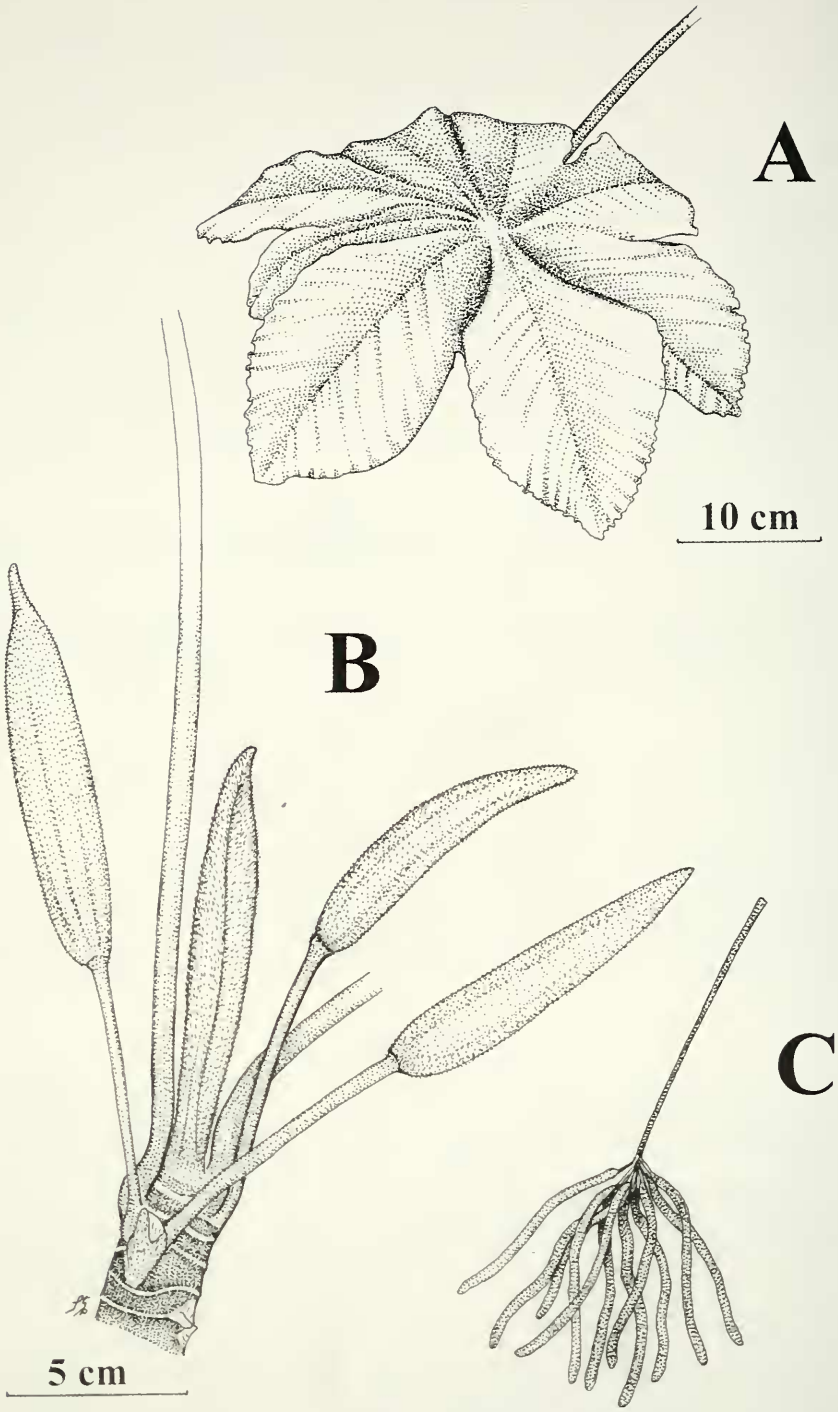

FIGURE 9. *Cecropia pittieri* (drawn from *Trusty 414*). A. Single palmate leaf. B. Fertile branch showing spathes enclosing inflorescences. C. Staminate inflorescence.

eat the fallen fruits (J. Trusty, pers. obs.). Seedlings have established under the parent tree. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 230*; *Trusty 492*.

CLUSIACEAE

1. Tree producing aerial roots, veins arcuate to the midrib; flowers pink . . . . . *Clusia rosea*
1. Shrub or tree not producing aerial roots; veins perpendicular to the midrib; flowers white . . . . . *Calophyllum inophyllum*

114. *Calophyllum inophyllum* L., Sp. Pl. 513–514. 1753.

DISTRIBUTION.— Frequent on Isla del Coco along the shore in Wafer and Chatham Bays. Native to Africa and the South Pacific but commonly cultivated in tropical America.

REMARKS.— First report for Isla del Coco. This species is listed as native due to the fact that it is a littoral species that has reached the island through oceanic drift.

SPECIMENS EXAMINED.— CR: *Quesada 1027*; *Rojas 3666*; FTG: *Trusty 133*; *Trusty 219*; INB: *Quesada 1027*; *Rojas 3666*.

115. *Clusia rosea* Jacq., Enum. Syst. Pl. 34. 1760.

DISTRIBUTION.— Common throughout Isla del Coco below 400 msl. Also found on many of the islets surrounding the island. Distributed from southern Florida to northern South America and the Antilles.

REMARKS.— *Clusia rosea* is an important nesting site for the brown and red-footed boobies (*Sula sula* and *S. melanogaster*) on the islets and cliffs of the island. In addition, the authors have seen the seeds eaten by the Cocos Island Finch (*Pinaroloxias inornata*).

SPECIMENS EXAMINED.— CR: *Dressler 4459*; *Gómez-Laurito 6940*; *Lépiz 381*; *Quesada 1051*; FTG: *Trusty 160*; *Trusty 340*; INB: *Lépiz 381*; *Quesada 1051*; USJ: *Gómez-Laurito 6940*; *Soto s.n.*

COMBRETACEAE

1. Leaves narrowly elliptical; fruits aggregated into a cone-like structure . . . . *Conocarpus erectus*
1. Leave obovate; fruits solitary, not aggregated. . . . . *Terminalia catappa*

116. *Conocarpus erectus* L., Sp. Pl. 176. 1753.

DISTRIBUTION.— Infrequent on Isla del Coco; found near the Genio River in Wafer Bay. Distributed in tropical and subtropical America and Africa.

REMARKS.— Although the island has no true mangroves, this is an important mangrove associate of tidal swamps on the mainland.

SPECIMENS EXAMINED.— CR: *Sánchez 24*; *Sánchez 25*; INB: *Quesada 1052*; USJ: *Soto 3855*.

117. *Terminalia catappa* L., Mant. 1:128. 1767.

DISTRIBUTION.— Common on Isla del Coco along the shorefront in Wafer and Chatham Bays. Native to the Old World but now widely distributed throughout the Americas.

SPECIMENS EXAMINED.— CR: *Jiménez s.n.*; *Quesada 1026*; *Quesada 1109*; *Rojas 3697*; *Sánchez 6*; *Valerio 1093*; FTG: *Trusty 38*; INB: *Quesada 1026*; *Quesada 1109*; *Rojas 3697*.

COMMELINACEAE

118. *Commelina diffusa* Burm. f., Flora Indica 18, pl. 7, f. 2. 1768.

DISTRIBUTION.— Common in the clearings near the Wafer Bay ranger station on Isla del Coco.

Distributed in subtropical and tropical regions of the world.

REMARKS.— *C. diffusa* is considered native here due to the early collection by Stewart (1912) but was probably introduced to the island by humans.

SPECIMENS EXAMINED.— FTG: *Trusty 130.*

CONVOLVULACEAE

1. Fruits indehiscent . . . . . *Stictocardia tiliifolia*
1. Fruits dehiscent 2
    2. Flowers white . . . . . *Ipomoea alba*
    2. Flowers blue or purple 3
        3. Plants not scandent not climbing . . . . . *Ipomoea pes-caprae*
        3. Plants climbing 4
            4. Sepals herbaceous; stigma lobes 3 . . . . . *Ipomoea indica*
            4. Sepals coriaceous; stigma lobes 2 . . . . . *Ipomoea philomega*

119. *Ipomoea alba* L., Sp. Pl. 161. 1753.

Ipomoea bona-nox L.

DISTRIBUTION.— Frequent in human created disturbed areas and steep areas that undergo landslides on Isla del Coco. Native to the tropics and subtropics of the New World but pantropical through cultivation.

SPECIMENS EXAMINED.— CR: *Quesada 1063*; FTG: *Trusty 204*; *Trusty 450*; INB: *Quesada 1063.*

120. *Ipomoea indica* (Burm.) Merr., Interp. Herb. Amboin. 445. 1917.

I. acuminata (Vahl) Roem. & Schult.; *I. learii* Pax

DISTRIBUTION.— Frequent in successional areas created by landslides on Isla del Coco. Pantropical in distribution.

REMARKS.— This species was published under the name *I. cathartica* Poir. in Stewart (1912).

SPECIMENS EXAMINED.— GH: *Pittier 16277.*

121. *Ipomoea pes-caprae* (L.) R. Br. in Tuckey, Narr. Exped. Zaire 477. 1818.

DISTRIBUTION.— Rare on Isla del Coco; found only along the shore at Iglesias Bay. Pantropical in distribution.

REMARKS.— Stewart (1912) collected this species from the beachfront at Wafer Bay where it was reported as common. This population no longer occurs at this location.

SPECIMENS EXAMINED.— CR: *Quesada 1131*; FTG: *Trusty 394*; USJ: *Soto 3860.*

122. *Ipomoea philomega* (Vell.) House, Ann. New York Acad. Sci. 18:246. 1908.

DISTRIBUTION.— Extremely common in human created disturbed areas and steep areas that undergo landslides on Isla del Coco. Distributed from Guatemala to Guiana and Peru, also found in the West Indies.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 447*; INB: *Quesada 1056.*

123. *Stictocardia tiliifolia* (Desr.) Hallier f., Bot. Jahrb. Syst. 18(1–2):159. 1893.

DISTRIBUTION.— Extremely common in human created disturbed areas and steep areas that undergo landslides on Isla del Coco. Native to Africa through Malaysia, naturalized from south Florida to Guyana, Peru and Ecuador, and also the West Indies.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Quesada 1103*; *Sánchez 11*; FTG: *Trusty 205*; *Trusty 449*; INB: *Quesada 1103*.

CUCURBITACEAE

124. **Momordica charantia* L., Sp. Pl. 1009. 1753.

DISTRIBUTION.— Escaped from cultivation on forest edge near the Wafer Bay ranger station on Isla del Coco. Found in the tropics and subtropics worldwide.

REMARKS.— This species is considered an invasive exotic in many island ecosystems (Swarbrick 1997, Space and Falanruw 1999), and we recommend its removal. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 83*.

CYPERACEAE

1. Inflorescence simple and unbranched 2
    2. Culms three-angled . . . . . *Eleocharis acutangula*
    2. Culms terete 3
        3. Inferior veins of the stem without laminas; inflorescence bracts less than 4 cm long . . . . . *Kyllinga nudiceps*
        3. Inferior veins of the stem with developed laminas; inflorescence bracts greater than 4 cm long . . . . . *Kyllinga brevifolia*
1. Inflorescence compound 4
    4. Spikelets compound . . . . . *Hypolytrum ampium*
    4. Spikelets simple 5
        5. Florets unisexual 6
            6. Plant erect to .7 m tall . . . . . *Calyptrocarya glomerulata*
            6. Plant scandent, stems 3–10 long . . . . . *Scleria secans*
        5. Florets bisexual 7
            7. Fertile scales spiraled 8
                8. Achene lacking tubercle . . . . . *Fimbristylis dichotoma*
                8. Achene with tubercle 9
                9. Spikelets pedicellate and arranged in panicles . . . . . *Rhynchospora polyphylla*
                9. Spikelets all sessile and arranged in heads 10
                10. Bracts adjacent to the head white basally . . . *Rhynchospora nervosa*
                10. Bracts adjacent to the head green . . . . . *Rhynchospora pubera* var. *parvula*
            7. Fertile scales distichous 11
                11. Spikelets in a solitary head, glomerulate . . . . . *Cyperus tenerrimus*
                11. Spikelets in spikes along a conspicuous rachis 12
                12. Rachilla articulated at the base of each scale, the mature spikelets disarticulating in segments formed by a scale, an internode and the wings of the raquilla . . . . . *Cyperus odorata*
                12. Rachilla continuous or articulated only at the base of the spikelet . . . 13
                13. Scales smooth; spikelets flattened 14
                14. Stolons lacking tubercles; mature fruit commonly formed . . . . . *Cyperus sphacelatus*

14. Stolons with tubercles present; mature fruit generally not formed. 15
15. Scales brown; base of the culm soft. . . *Cyperus esculentus*
15. Scales brown with a green midvein; base of the culm hardened. . . . . *Cyperus rotundus*
13. Scales plicate; spikelets quadrangular or subterete 16
16. Culms, rays and leaf lamina papillose; leaves asperously scabrous on the margins and the medial nerves . . . . . *Cyperus ligularis*
16. Culms, rays and leaf lamina not papillose; leaves scaberulose or smooth on the margins and the medial nerves 17
17. Scales green: spikes densely ovoid . . . . . *Cyperus tenuis*
17. Scales brown; spikes cylindrical . . . . . *Cyperus hermaphroditus*

125. *Calyptrocarya glomerulata* (Brongn.) Urb., Symb. Ant. 2:169. 1900.

C. longifolia (Rudge) Kunth; *C. palmetto* Nees

DISTRIBUTION.— Common along rivers and streams throughout Isla del Coco. Native from Mexico to Brazil.

SPECIMENS EXAMINED.— CR: *Dauphin 1168*; *Gómez-Laurito 6920*; *Jiménez 3176*; *Murawski 307*; *Pittier 16274*; *Quesada 1018*; *Soto s.n.*; FTG: *Trusty 84*; *Trusty 286*; GH: *Pittier 16274*; INB: *Quesada 1018*; US: *Barclay 2189*; *Gómez 3263*; *Howell 10188*; *Pittier 12376*; *Pittier 16274*; USJ: *Castaing s.n.*; *Dauphin 1168*; *Gómez-Laurito 6957*; *Gómez-Laurito s.n.*; *Soto s.n.*

126. *Cyperus hermaphroditus* (Jacq.) Standl., Contr. U.S. Natl. Herb. 18:88. 1916.

DISTRIBUTION.— Frequently found in the lawn area of the Wafer Bay ranger station on Isla del Coco. Distributed from Texas to northern Argentina; also found in the Antilles.

REMARKS.— *C. hermaphroditus* is considered native here due to the early collections but may have been introduced to the island by humans.

SPECIMENS EXAMINED.— CAS: *Stewart 269*; CR: *Gómez-Laurito 6958*; FTG: *Trusty 86*; *Trusty 388*; *Trusty 448*; GH: *Snodgrass and Heller 946A*; USJ: *Soto s.n.*

127. **Cyperus ligularis* L., Syst. Nat. ed. 10, 2:867. 1759.

DISTRIBUTION.— Infrequent on Isla del Coco; found near drainage ditch near Wafer Bay ranger station. Distributed in subtropical and tropical areas throughout the world.

SPECIMENS EXAMINED.— CR: *Gómez-Laurito 6927*; *Sánchez 21*; FTG: *Trusty 135*.

128. *Cyperus odoratus* L., Sp. Pl. 46. 1753.

DISTRIBUTION.— Frequent in clearings and near drainage areas near the Wafer Bay ranger station on Isla del Coco. Found in the tropics and subtropics throughout the world.

Remarks. — This species was published under the name *C. prolixus* Kunth in Stewart (1912).

SPECIMENS EXAMINED.— BKL: *Svenson 310*; CAS: *Stewart 266*; CR: *Pittier 16271*; FTG: *Trusty 468*; US: *Klawe 1503*.

129. **Cyperus rotundus* L., Sp. Pl. 45. 1753.

DISTRIBUTION.— Rare; found in Wafer Bay on Isla del Coco. Distributed in the tropics and subtropics throughout the world.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 3386* (not seen).

130. *Cyperus sphacelatus* Rottb., Descr. Pl. Rar. 21. 1772.

DISTRIBUTION.— Frequent in the lawn area of the Wafer Bay ranger station and on the banks of the Genio River on Isla del Coco. Distributed from Honduras to northern South America and the Antilles; also in tropical Africa.

REMARKS.— *C. sphacelatus* is considered native here due to the early collections but is probably introduced to the island by humans. This species was published under the name *C. esculentus* L. in Svenson (1935).

SPECIMENS EXAMINED.— CAS: *Stewart 267*; *Stewart 268*; GH: *Snodgrass and Heller 946B*.

131. **Cyperus tenerrimus* J. Presl & C. Presl in C. Presl, Reliq. Haenk. 1(3):166. 1828.

DISTRIBUTION.— Rare; found in Wafer Bay on Isla del Coco. Distributed from southern Mexico to Costa Rica.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Murawski 365* (not seen).

132. **Cyperus tenuis* Sw., Prodr. 20. 1788.

DISTRIBUTION.— Rare; found in the thickets at French Point on Isla del Coco. Distributed from Mexico to Brazil; also found in the West Indies and tropical Africa.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 3281* (not seen).

133. **Eleocharis acutangula* (Roxb.) Schult., Mant. 2:91. 1824.

E. fistulosa Schult.

DISTRIBUTION.— Infrequent in Wafer Bay on Isla del Coco. Pantropical in distribution.

SPECIMENS EXAMINED.— CR: *Gómez-Laurito 6915* (not seen).

134. **Fimbristylis dichotoma* (L.) Vahl, Enum. Pl. 2: 287. 1805.

DISTRIBUTION.— Frequent in the lawn area of the Wafer Bay ranger station on Isla del Coco. Found at low altitudes in temperate and tropical areas of the world.

SPECIMENS EXAMINED.— CR: *Gómez 3384*; *Soto s.n.*; FTG: *Trusty 90*; *Trusty 355*.

135. *Hypolytrum amplum* Poepp. & Kunth in Kunth, Enum. Pl. 2:272. 1837.

DISTRIBUTION.— Extremely common in the closed canopy forest up to 450 msl throughout the island. Distributed in Costa Rica, Peru, Venezuela, the Guianas and Brazil.

REMARKS.— This species is currently the most common understory component of Isla del Coco. It forms dense stands especially near Cabo Atrevido. This species was published under the name *H. nicaraguense* Liebm. in Stewart (1912) and Svenson (1935).

SPECIMENS EXAMINED.— CR: *Dauphin 1163*; *Dressler 4473*; *Gómez 3313*; *Gómez-Laurito 6921*; *Gómez-Laurito 6936*; *Jiménez 3144*; *Murawski 306*; *Murawski 327*; *Soto s.n.*; *Valerio 1109*; FTG: *Trusty 50*; GH: *Pittier 16273*; *Stewart 271*; INB: *González 1143*; *Quesada 1005*; US: *Klawe 1503*; *Pittier 12380*; *Pittier 16273*; USJ: *Castaing s.n.*; *Dauphin 1163*; *Soto s.n.*

136. **Kyllinga brevifolia* Rottb., Descr. Icon. Rar. Pl. 13, pl. 4, f. 3. 1773.

DISTRIBUTION.— Common in the lawn near the Wafer Bay ranger station on Isla del Coco. Distributed from the southern United States to Argentina.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 87*; *Trusty 356*.

137. ***Kyllinga nudiceps*** C.B. Clarke ex Standl., Publ. Field Columbian Mus., Bot. Ser. 4(8): 199. 1929. (Fig. 10)

TYPE: *Pittier 16272* (holotype: US!; isotypes: F, GH!, LCU, NY!).

Cyperus nudiceps (C.B. Clarke ex Standl.) O'Neill

Tufted perennial, (10) 25–40 (55) cm tall; rhizome short, oblique, 1–3 cm long, (0.5) 2–3 mm thick, closely covered with overlapping reddish-brown, broadly ovate scales 1–3 mm long; roots brownish, finely pubescent especially near the rhizome; leaves bladeless, the base of the culms with about 3 reddish-brown, scarious sheaths (0.6) 2–8 cm long, densely reddish spotted along the apical margins; culms 0.4–0.8 mm thick just above the apex of the longest sheath, 0.4–0.6 (0.9) mm thick just below the inflorescence; inflorescence bracts 2 or 3, rather broadly ovate, 1.3–2.8 (3.5) mm long, the cusp an additional 1–2 mm long, 1.4–2.5 mm wide, light reddish brown to sordid whitish, smooth or often sparsely scabrous along the keel distally, erect to ascendent at anthesis, stiffly erect and clasping the rachis after the spikelets fall; spike loosely hemispherical, 3.5–4.5 mm high, 5–6 mm wide; rachis cylindric, (0.9) 1.3–1.8 mm long, (0.4) 0.6–0.8 mm thick; spikelet pedicels rather densely packed, separated by less than their own width, 0.2–0.35 mm long, 0.15–0.2 mm wide, abaxially with a conspicuous toothlike scar from the lowest sterile scale; spikelets 15–45, elliptic, 2–2.8 mm long, 0.7–1.2 mm wide, dull white to light greenish-brown; scales 2–2.4 mm long 1.4–2.1 mm wide, 7–11 nerved, keel green to dull whitish, smooth, the apiculate apex up to 0.1 mm long; stamens 1, 2, or 3; filaments dirty white to light brown, 2–3 mm long; anthers linear oblong, 0.8–1.1 mm long, the connective tip reddish, up to 0.1 mm long. Styles 0.4–1.4 mm long; stigmatic branches 2, 1.4–2 mm long; achenes lenticular, broadly ovate, 1.1–1.2 mm long, 0.75–0.8 mm wide, the apex obtuse, the style persistent, the base cuneate to substipitate, surface essentially smooth, light brown.

DISTRIBUTION.— Restricted to wet, open areas near the Iglesias Bay waterfall. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Holst and Soto s.n.*; *Jiménez 3204*; *Pittier 16272*; *Quesada 1067*; FTG: *Trusty 401*; INB: *Quesada 1067*; NY: *Pittier 16272*; *Tucker s.n.*; US: *Klawe 1501*; *Pittier 16272*; *Snodgrass and Heller 944*.

138. **Rhynchospora nervosa* (Vahl) Boeck., Vidensk. Meddel. Dansk Naturhist. Føren. Kjøbenhavn 143. 1869.

DISTRIBUTION.— Rare; found in Wafer Bay on Isla del Coco. Distributed throughout the Neotropics.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 3382* (not seen).

139. **Rhynchospora polyphylla* (Vahl) Vahl. Enum. pl. 2:230. 1805.

DISTRIBUTION.— On beachside cliffs and in open areas near Wafer Bay on Isla del Coco. Distributed from southern Mexico to Peru and Brazil; also found in the Antilles.

SPECIMENS EXAMINED.— FTG: *Trusty 238*; *Trusty 400*; *Trusty 534*; INB: *Quesada 1068*; *Quesada 1076*; US: *Gómez 3277*; *Klawe 1495*.

140. **Rhynchospora pubera* (Vahl) Boeck. subsp. *parvula* (Vahl) Boeck., Linnaea 37:528. 1873.

DISTRIBUTION.— Found in open areas along the trail from Wafer Bay to Chatham Bay on Isla del Coco. Distributed from Costa Rica to Colombia and Venezuela.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 408*.

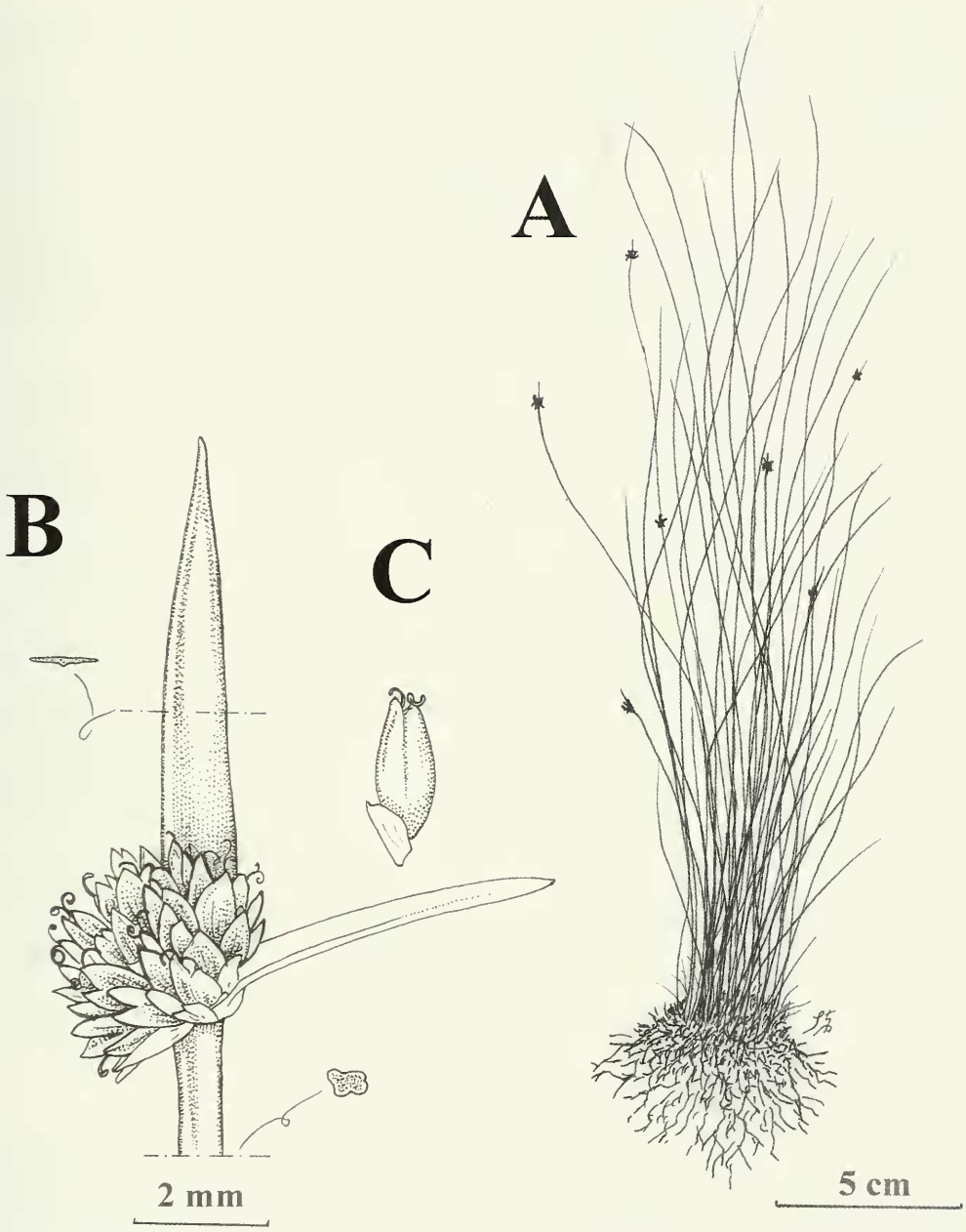

FIGURE 10. *Kyllinga nudiceps* (drawn from *Trusty 401*). A. Habit of fertile plant. B. Close up of inflorescence showing cross-sections of inflorescence bract and culm. C. Close up of single spikelet.

141. **Scleria secans* (L.) Urb., Symb. Ant. 2:169. 1900.

DISTRIBUTION.— Rare on Isla del Coco; found only near the remains of a World War II airplane on Cerro Iglesias. Native from Mexico to Bolivia and Brazil, also in the West Indies.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 272*.

EUPHORBIACEAE

1. Leaves conspicuously lobed 2
    2. Leaves not peltate; stamens 10 . . . . . *Manihot esculenta*
    2. Leaves peltate; stamens numerous . . . . . *Ricinus communis*
1. Leaves simple and not lobed. 3
    3. Shrubs or trees 4
        4. Leaves completely green . . . . . *Acalypha pittieri*
        4. Leaves with white, gold or red coloration 5
            5. Leaves linear, margin entire to subulate . . . . . *Cordiaeum variegatum*
            5. Leaves elliptic, margins toothed . . . . . *Acalypha wilkesiana*
    3. Herbs 6
        6. Capsules and stems pubescent . . . . . *Chamaesyce hirta*
        6. Capsules and stems glabrous . . . . . *Chamaesyce hyssopifolia*

142. ***Acalypha pittieri*** Pax & K. Hoffm.. Pflanzenr. IV. 147, 16:18. 1924. (Fig. 11)

TYPE: *Pittier 16246* (holotype: US!; isotype: GH!)

Shrub; branches velvety-pubescent; plants monoecious or dioecious; stipules 3–12 mm × 2 mm, ovate-lanceolate and acuminate, scarious, pubescent on the midrib and margins; leaves with petioles 6–14 (23) cm long, densely pubescent, small glands present at the apex; leaf blades elliptic to ovate, 10–20 × 4–8 cm, apex cuspidate-acuminate 1–2.3 mm long, base widely obtuse to slightly cordate, margins serrate with 27–55 teeth/side, upper side of leaf sparsely pubescent on major veins with hairs to 1mm, lower side densely pubescent with hairs 1–2 mm long, without glands, basally palmate to subpalmate, 5-nerved, secondary veins 8–9 on each side; staminate inflorescence unknown; pistillate spike (6) 9–12.5 cm long and 3–6 mm wide, axillary, densely pubescent, extremely delicate, loosely bractate, the bracts small, 1-flowered; female flowers sessile; sepals ovate, white ciliate; ovary 0.5 × 0.5 mm globose, glabrous to verrucose; styles 2–3 mm long, 8–12 laciniate, branches exerted, reddish; fruits not enclosed in bracts, peduncles .5–2 mm long; sepals reflexed, fruits globose 1–1.5 mm in diameter; seeds 0.8 mm, smooth, ovoid-globose, light brown.

DISTRIBUTION.— Rare; near the coast in Wafer Bay. Endemic to Isla del Coco.

REMARKS.— This species was reduced to the synonomy of *A. macrostachya* Jacq. by Burger and Huft (1995) but upon examination of the type specimen, it is recognized as a distinct species by its thin, delicate inflorescences, sessile flowers and fruits which are not enclosed in enlarged bracts. This species has not been collected from Cocos Island since 1902. This species was published under the name *A. bisetosa* Bert. in Stewart (1912) and Svenson (1935).

SPECIMENS EXAMINED.— CAS: *Stewart 300*; GH: *Pittier 16246*; US: *Pittier 16246* (photo).

143. **Acalypha wilkesiana* Müll. Arg. in DC., Prodr. 15(2):817. 1866.

DISTRIBUTION.— No longer occurs on Isla del Coco but previously found near habitations Svenson (1935). Native to the Pacific Islands but cultivated throughout the world.

SPECIMENS EXAMINED.— BKL: *Svenson 319*; US: *Howell 10172*.

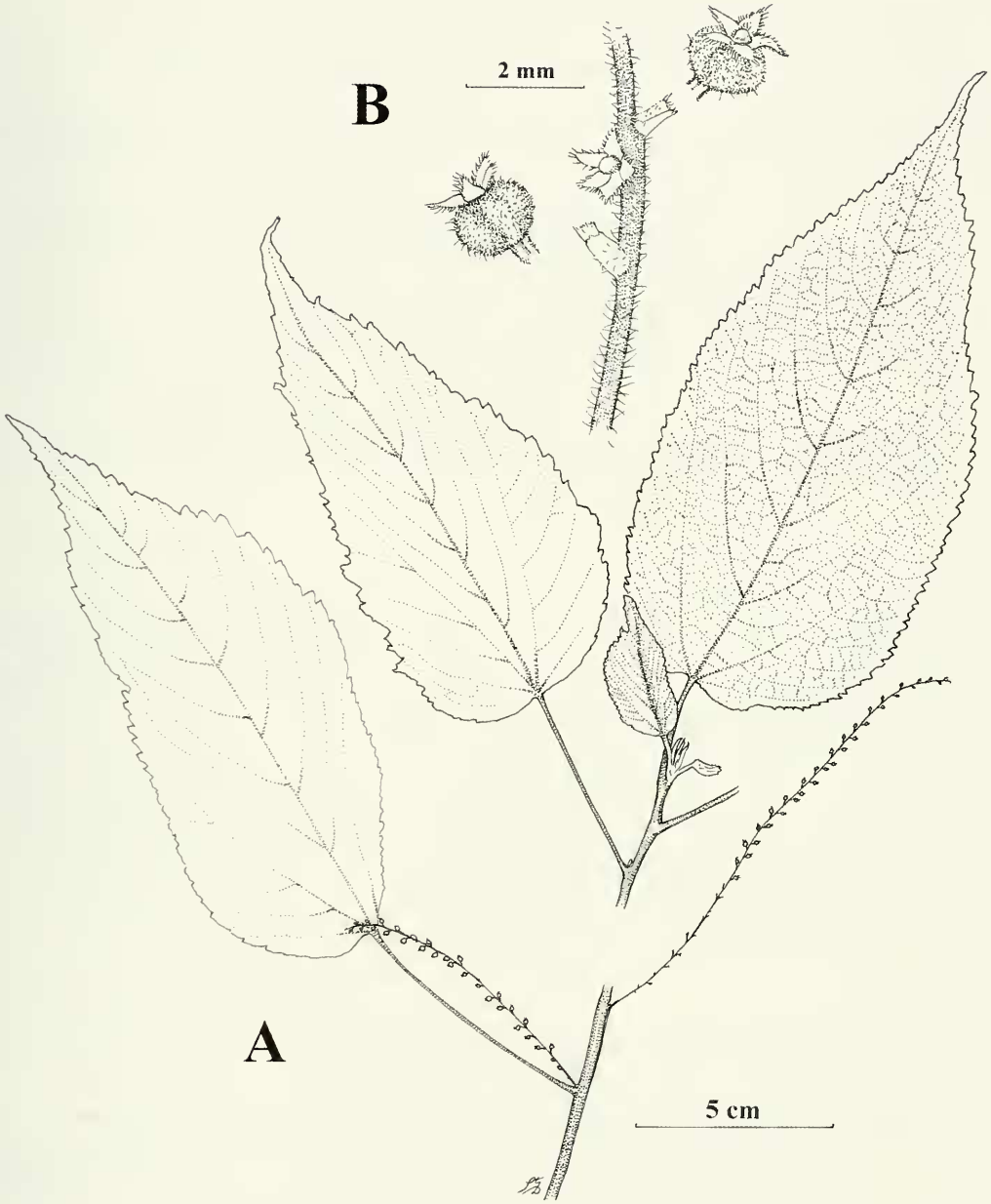

FIGURE 11. *Acalypha pittieri* (drawn from *Stewart 300*). A. Branch of plant including pistillate inflorescences. B. Portion of pistillate branch with young fruits.

144. **Chamaesyce hirta* (L.) Millsp., Publ. Field Columbian Mus. Bot. ser. 2:303. 1909.
Euphorbia hirta L.; *E. pilulifera* L.

DISTRIBUTION.— Common in disturbed and cleared areas on Isla del Coco. *C. hirta* is a pantropical weed.

SPECIMENS EXAMINED.— CR: *Gómez-Laurito 6928*; FTG: *Trusty 89*; INB: *Quesada 1041*; *Rojas 3707*; US: *Foster 4146*; USJ: *Soto s.n.*

145. **Chamaesyce hyssopifolia* (L.) Small, Bull. New York Bot. Gard. 3:429. 1905.

DISTRIBUTION.— Common in disturbed and cleared areas on Isla del Coco. Found throughout tropical America and adventive in the Old World.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *L. González 649*; *Quesada 1038*; *Rojas 3715*; FTG: *Trusty 74*; INB: *Quesada 1038*; *Rojas 3715*; USJ: *Soto s.n.*

146. **Codiaeum variegatum* (L.) Juss., Euphorb. Gen. 80, III, pl. 9, f. 30. 1824.

DISTRIBUTION.— Cultivated on Isla del Coco near the Wafer Bay ranger station. Native to the Pacific Islands but widely cultivated throughout the world.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 305*.

147. **Manihot esculenta* Crantz, Inst. Rei. Herb. 1:167. 1766.

DISTRIBUTION.— Cultivated on Isla del Coco near the Wafer Bay ranger station. Native to South America but widely cultivated in the tropics.

REMARKS.— This species is reported to have become naturalized in Hawaii (Swearingen 2003) and should therefore be monitored closely on Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 82*.

148. **Ricinus communis* L., Sp. Pl. 1007. 1753.

DISTRIBUTION.— Previously cultivated in Wafer Bay on Isla del Coco. Native to East Africa but now widely distributed throughout the world.

SPECIMENS EXAMINED.— USJ: *Gómez s.n.*

FABACEAE

1. Leaves simple . . . . . *Dalbergia brownei*
1. Leaves compound 2
    2. Vines. 3
        3. Leaves trifoliolate 4
            4. Stems and petioles bearing conspicuous, spreading, brownish trichomes . . . . . .*Vigna vexillata*
            4. Stems and petioles lacking spreading, brown trichomes 5
                5. Inflorescence erect; legumes not covered in irritating trichomes . . . . . *Canavalia maritima*
                5. Inflorescence pendent; legumes densely covered in irritating trichomes 6
                6. Flowers yellow . . . . . *Mucuna sloanei*
                6. Flowers pinkish. . . . . *Mucuna mutisiana*
        3. Leaves bipinnate 7
            7. Spines present . . . . . .*Caesalpinia bonduc*
            7. Spines absent . . . . . .*Entada monostachya*

2. Herbs, shrubs or trees 8
    8. Shrubs or trees 9
        9. Leaves bipinnate . . . . . *Zapoteca tetragona*
        9. Leaves pinnate 10
            10. Stamens united . . . . . *Erythrina fusca*
            10. Stamens free 11
                11. Leaflets 8–12; legume compressed and flat 12
                11. Leaflets 4–8; legume cylindrical . . . . . *Cassia fistula*
                12. Foliage and inflorescence densely stellate pubescent . . . . . *Caesalpinia eriostachys*
                12. Foliage and inflorescence without stellate hairs . . . *Senna reticulata*
    8. Herbs 13
        13. Leaflets often emarginate at the apex . . . . . *Desmodium adscendens*
        13. Leaflets not emarginate at the apex 14
            14. Leaves strictly trifoliolate . . . . . *Desmodium incanum*
            14. Leaves 1–3 foliolate . . . . . *Desmodium procumbens* var. *longipes*

149. *Caesalpinia bonduc* (L.) Roxb., Fl. Ind., ed. 2:362. 1832.

C. bonducella (L.) Fleming

DISTRIBUTION.— Infrequent; found along the rocky beachfront of Isla del Coco. Distributed in the tropics and subtropics of the world.

REMARKS.— This species was published under the name *C. crista* L. in Fosberg and Klawe (1966).

SPECIMENS EXAMINED.— FTG: *Trusty 454*; GH: *Pittier 16281*; INB: *Quesada 1035*; US: *Klawe 1559*; *Pittier 16281*; US: *Klawe 1559*; *Pittier 16281*; USJ: *Soto s.n.*

150. *Caesalpinia eriostachys* Benth., Bot. Voy. Sulphur 88. 1844.

DISTRIBUTION.— Unknown distribution on Isla del Coco.

REMARKS.— This species was reportedly collected by Barclay both on Isla del Coco and the Nicoya peninsula of Costa Rica. It is a typical dry forest species on the mainland and we believe the specimen from Isla del Coco may have been mislabeled. No other collections have been made from the island.

SPECIMENS EXAMINED.— K: *Barclay s.n.* (not seen).

151. *Canavalia maritima* (Aubl.) Thouars, J. Bot. Agric. 1:80–81. 1813.

C. rosea (Sw.) DC.

DISTRIBUTION.— Frequent; found along the rocky beachfront and near the lower part of the Rio Genio in Wafer Bay of Isla del Coco. Widely distributed along beaches in the tropics and warm regions of the world.

SPECIMENS EXAMINED.— FTG: *Trusty 234*; *Trusty 484*; US: *Klawe 1560*.

152. **Cassia fistula* L., Sp. Pl. 377–378. 1753.

DISTRIBUTION.— Cultivated in Wafer Bay on Isla del Coco. Native to Southeast Asia but cultivated in tropical areas throughout the world.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 197*.

153. *Dalbergia monetaria* L. f., Suppl. Pl. 317. 1781 [1782].

DISTRIBUTION.— Collected along the Sucio River in Chatham Bay on Isla del Coco. Distributed

from Florida and southern Mexico to Colombia and Peru, also in the West Indies.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Quesada 1106*; INB: *Quesada 1106*.

154. **Delonix regia* (Bojer ex Hook.) Raf., Fl. Tellur. 2:92. 1836 [1837].

DISTRIBUTION.— Cultivated on Isla del Coco near the Wafer Bay ranger station. Native of Madagascar but planted in most tropical regions of the world. Distributed from Texas and Mexico thoughout the West Indies and Central and South America; introduced and cultivated worldwide.

SPECIMENS EXAMINED.— CR: *Lépiz 363*; *Quesada 1054*; INB: *Lépiz 363*; *Quesada 1054* USJ: *Lépiz 363*.

155. **Desmodium adscendens* (Sw.) DC., Podr. 2: 332. 1825.

DISTRIBUTION.— Common on Isla del Coco in full sun along the disturbed part of the trail between Chatham and Wafer Bays. Distributed from Mexico to South America, the West Indies, and tropical Africa.

SPECIMENS EXAMINED.— CR: *Quesada 1101*; FTG: *Trusty 103*; INB: *Lépiz 368*; *Lépiz 370*; *Quesada 1101*.

156. *Desmodium incanum* DC., Prodr. 2:332. 1825.

Desmodium canum (G.F. Gmel) Shinz & Thellung

DISTRIBUTION.— Common in full sun on Isla del Coco along the disturbed part of the trail between Chatham and Wafer Bays. Distributed throughout the New World tropics and tropical Africa.

SPECIMENS EXAMINED.— CR: *Gómez-Laurito 6952*; *Jiménez s.n.*; *Quesada 1100*; FTG: *Trusty 257*; *Trusty 364*; INB: *González 1153*; *Lépiz 369*; *Quesada 1100*; USJ: *Soto 3857*; *Soto s.n.*

157. **Desmodium procumbens* var. *longipes* (Schindl.) B. G. Schub. Contr. Gray Herb. 129: 8–11. 1940.

DISTRIBUTION.— Common on Isla del Coco in full sun along the disturbed part of the trail between Chatham and Wafer Bays. Distributed from northern Mexico to northern South America; also in the Old World tropics.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 348*.

158. *Entada gigas* (L.) Fawc. & Rendle, Fl. Jamaica 4:124. 1920.

DISTRIBUTION.— Common throughout Isla del Coco forming large lianas in the closed forest. Distributed in Central America and tropical South America, the West Indies, and West Africa.

SPECIMENS EXAMINED.— CR: *Rojas 3690*; FTG: *Trusty 300*; *Trusty 403*; INB: *Lépiz 375*; *Quesada 1107*; *Rojas 3690*; USJ: *Soto s.n.*

159. *Erythrina fusca* Lour., Fl. Cochinch. 427. 1790.

DISTRIBUTION.— Infrequent; found along the shoreline in Wafer Bay in Isla del Coco. Found from Guatemala throughout the Amazon basin, the West Indies and throughout the Old World tropics.

SPECIMENS EXAMINED.— CR: *Quesada 1132*; *Sánchez 3*; FTG: *Trusty 220*; INB: *Quesada 1132*.

160. *Mucuna mutisiana* (Kunth) DC., Prodr. 2:406. 1825.

DISTRIBUTION.— Frequent in Isla del Coco along the beachfront at Wafer Bay. Distributed from Panama to Venezuela.

REMARKS.— R. Soto (Government of Costa Rica 1996) stated that the island populations of this

species have undergone a change in floral color compared with mainland populations. He suggested that this may be due to a change in pollinator.

SPECIMENS EXAMINED.— CR: *Quesada 1025*; FTG: *Trusty 175*; INB: *Quesada 1025*.

161. *Mucuna sloanei* Fawc. & Rendle, J. Bot. 55:36. 1917.

M. urens (L.) DC.

DISTRIBUTION.— Frequent in Isla del Coco along the beachfront at Wafer Bay. Distributed in Central and South America, the Antilles and Africa.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 235*; INB: *Soto 1*.

162. *Senna reticulata* (Willd.) H.S. Irwin & Barneby, Mem. New York Bot. Gard. 35:458. 1982.

Cassia reticulata Willd.

DISTRIBUTION.— Cultivated on Isla del Coco near ranger station in Wafer Bay. Native from Mexico to Bolivia and Brazil.

REMARKS.— Although this plant is found in wet areas throughout the American tropics, the Cocos Island specimens appear to be maintained in cultivation. No plants were found in the forest.

SPECIMENS EXAMINED.— FTG: *Trusty 278*.

163. *Vigna vexillata* (L.) A. Rich. in Sagra, Hist. Fis. Cuba, Bot. 10:191. 1845.

DISTRIBUTION.— Near the beach edge at the mouth of the Genio River in Wafer Bay on Isla del Coco. Native to the Old World but pantropical in distribution.

SPECIMENS EXAMINED.— USJ: *Soto 3864*.

164. *Zapoteca tetragona* (Willd.) H. M. Hern., Ann. Missouri Bot. Gard. 73:757. 1986 [1987].

DISTRIBUTION.— Collected once on Isla del Coco near Chatham Bay. Distributed from Mexico to Ecuador.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Quesada 1135*; INB: *Quesada 1135*.

GENTIANACEAE

165. *Voyria aphylla* (Jacq.) Pers., Syn. Pl. 1:284. 1805.

DISTRIBUTION.— Infrequent in the closed canopy forest between 200–450 msl on Isla del Coco. Distributed from throughout tropical America and the West Indies.

SPECIMENS EXAMINED.— FTG: *Trusty 51*; INB: *González 1159*.

GESNERIACEAE

166. *Kohleria spicata* (Kunth) Oerst., Centralamer. Gesner. 27. 1858.

K. longifolia (Lindl.) Hanst. var. *petiolaris* (Benth.) C. V. Morton

DISTRIBUTION.— Frequent along the rocky beachfront around Isla del Coco. Distributed from southern Mexico to northern South America.

SPECIMENS EXAMINED.— CR: *Gómez 3296*; FTG: *Trusty 232*; *Trusty 451*; *Trusty 464*; GH: *Pittier 16256*.

HUMIRIACEAE

167. ***Sacoglottis holdridgei*** Cuatrec., Ciencia (Mexico) 23:138–139. 1964. (Fig. 12)

TYPE: *Holdridge 5164* (holotype: US).

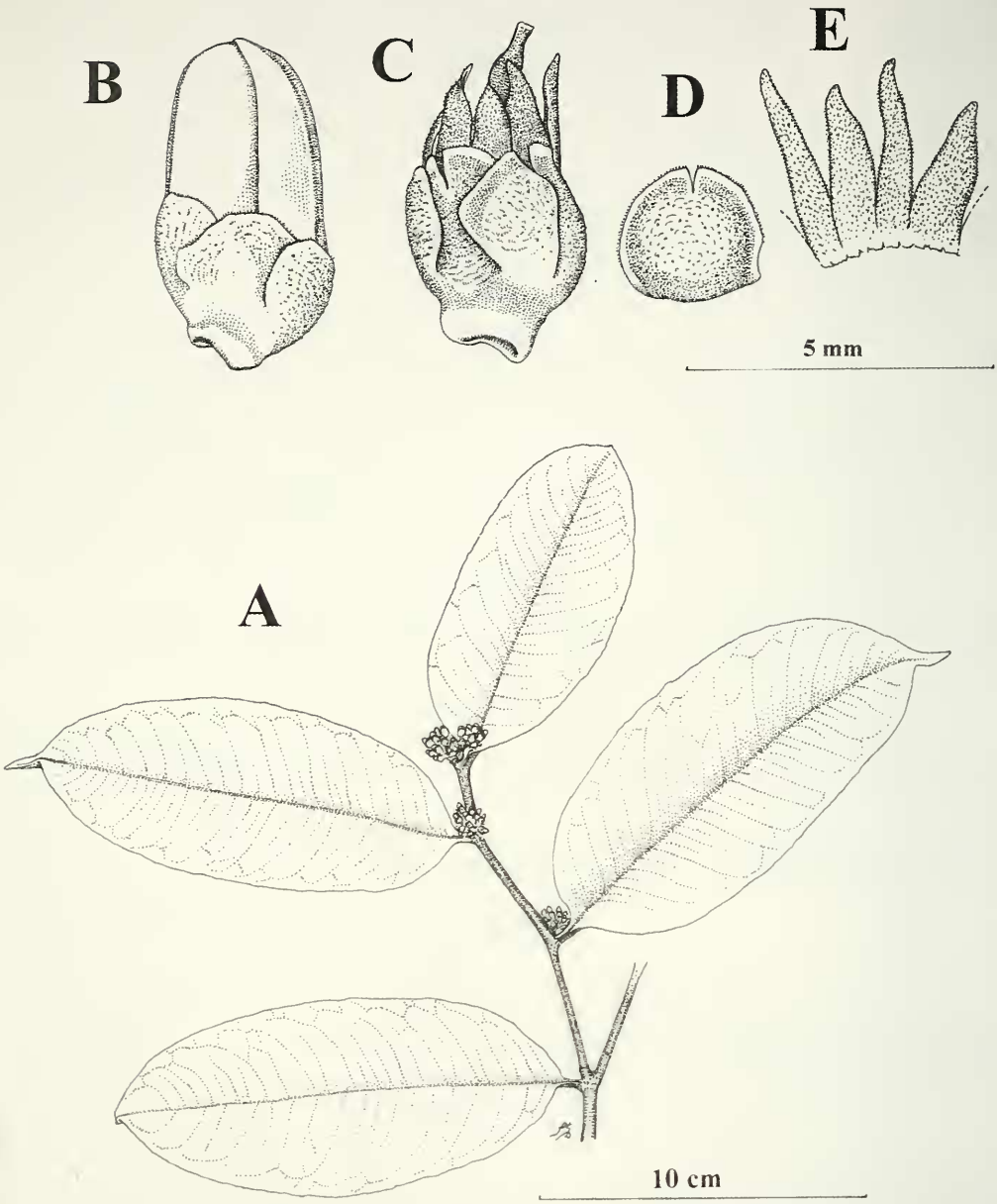

FIGURE 12. *Sacoglottis holdridgei* (drawn from *Trusty 453*). A. Branch of plant showing axillary inflorescences. B. Close up of closed flower bud. C. Close up of flower bud with petals removed. D. Sepal. E. Anther filaments lacking thecae.

Medium to large trees, to 25 m tall and with trunks to 1 m dbh, leafy branchlets with internodes 1–3.5 cm long, 1.5 mm thick, glabrous, subterete; stipules 0.5–1 mm long, caducous. Leaves alternate and distichous, petioles 4–7 mm long, 2–4 mm thick, with adaxial ridges continuous with the lamina margins, glabrous; leaf blades 7–13 (15) cm long, 4.2–6.5 (8) cm borad, oblong-ovate to ovate-elliptic, abruptly short-acuminate at the apex, rounded to truncate at the base, margin entire or slightly sinuate-crenate, minutely glandular punctate at the margin, drying dark grayish brown to almost black above, paler beneath, glabrous above and below, with 8–11 major secondary veins on each side, the sentral secondaries arising at angles of 70–90°, weakly loop-connected near the margin. Inflorescences axillary, 0.5–3 cm long, cymose-paniculate, subsessile or sessile (and appearing as several inflorescences in the leaf axil), peduncle 0–4 mm long, branches dichotomous, 1–4 mm long, sparsely and minutely papillate-puberulent, bracts ca. 2.5 mm long, 1 mm broad, deciduous, pedicels ca. 0.5 mm long. Flowers green to greenish yellow, calyx 1.7–2 mm high, calyx lobes ca. 2 mm broad, broadly rounded and suborbicular, glabrous but minutely ciliolate along the edge; petals ca. 5.5 mm long and 2 mm broad, narrowly oblong; stamens 10, glabrous, the longer filaments 4 mm long and sepal-opposed, the shorter filaments 3 mm long and petal-opposed, anthers ca. 1 mm long, ovate, thecae orange, attached at the base of the connective, annular disc cupulate, ca. 0.8 mm high, with denticulate margin; ovary ca. 1.5 mm long, oviod, style ca. 2.5 mm long, columnar. Fruits 32–40 mm long, 21–32 mm in diameter, oblong-ellipsoid, sepals persisting at the base, exocarp 2–4 mm thick, endocarp woody, irregulary 5 septate, resin vesicles with lustrous interior surfaces; seeds ca. 12 mm long, 4 mm in diameter, oblong.

Distribution.— Extremely common throughout the island. Endemic to Isla del Coco.

Remarks.— The name Isla del Coco is a misnomer from the original map in 1546 where the island was called 'Ile de Cocques" which is French for "seed island." Those seeds are most likely those of *S. holdridgei*, which are abundant along the beach and throughout the island.

Specimens examined.— CR: *Dauphin 1091*; *Dressler 4458*; *Dressler 4467*; *Foster 4126*; *Gómez 3298*; *Gómez 18055*; *Gómez-Laurito 6934*; *Gómez-Laurito 6966*; *González 1149*; *Jiménez 3179*; *Lépiz 328*; *Murawski 348*; *Poveda 813*; *Quesada 1013*; *Rojas 3631*; *Rojas 3654*; FTG: *Trusty 59*; *Trusty 162*; *Trusty 261*; *Trusty 453*; INB: *González 1149*; *Lépiz 328*; *Quesada 1013*; *Rojas 3631*; *Rojas 3654*; NY: *Dressler 4458*; *Dressler 4467*; *Foster 4126*; *Gómez 3298*; *González 1149*; *Rojas 3631*; USJ: *Castaing s.n.*; *Poveda 813*; *Soto 3859*.

Lamiaceae

1. Flowers in compact heads ..... *Hyptis capitata*
1. Flowers not in compact heads ..... *Salvia occidentalis*

168. **Hyptis capitata* Jacq., Coll. 1:102. 1787.

Distribution.— Common in open areas along trails on Isla del Coco. Found from Mexico to Colombia, Venezuela, Ecuador, and Peru; also in the West Indies, Asia and Polynesia.

Specimens examined.— CR: *Gómez 3293*; *Sánchez 19*; *Soto s.n.*; FTG: *Trusty 253*; *Trusty 301*; *Trusty 446*; INB: *Quesada 1059*.

169. **Salvia occidentalis* Sw., Prodr. 14. 1788.

Distribution.— Locally common on Isla del Coco near the beachfront in Wafer Bay. Distributed throughout the American tropics.

Remarks.— This is probably a very recent introduction by humans to Isla del Coco due to the recent collection by us and its restricted distribution on the island near human settlements. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 350*.

LAURACEAE

1. Leaf blades densely pubescent on the lower surface ..... *Persea americana*
1. Leaf blades essentially glabrous..... *Ocotea insularis*

170. *Ocotea insularis* (Meisn.) Mez, Jahrb. Königl. Bot. Gart. Berlin 5:271. 1889.

DISTRIBUTION.— Common throughout Isla del Coco from 0–400 msl. Distributed from northern Costa Rica to Ecuador.

REMARKS.— Originally described from Isla del Coco, *O. insularis* has been found in continental Central and South America.

SPECIMENS EXAMINED.— CR: *Dauphin 1052*; *Dauphin 1181*; *Foster 4114*; *Gómez 18041*; *Gómez-Laurito 6938*; *Gómez-Laurito 6946*; *Howell 10185*; *Jiménez 3183*; *Poveda 821*; *Rojas 3676*; *Rojas 3682*; *Sánchez 23*; FTG: *Trusty 173*; *Trusty 312*; *Trusty 339*; *Trusty 502*; INB: *González 1155*; *Lépiz 374*; *Quesada 1020*; *Rojas 3671*; *Rojas 3676*; *Rojas 3682*; USJ: *Gómez-Laurito 6938*; *Gómez-Laurito 6946*; *Poveda 821*; *Soto 3853*.

171. **Persea americana* Mill., Gard. Dict. Ed. 8. 1768.

DISTRIBUTION.— Persisting from cultivation on Isla del Coco in the clearing near the radio tower in Chatham Bay. Native to the Mexico and Central America but cultivated widely in the tropics and subtropics.

SPECIMENS EXAMINED.— CR: *Gómez 18054*; FTG: *Trusty 522*; INB: *González 1144*; USJ: *Soto s.n.*

MALVACEAE

1. Fertile stamens as many as petals ..... *Theobroma cacao*
1. Fertile stamens not equal in number to petals 2
   2. Leaf blades not toothed 3
      3. Flowers white; fruit densely woolly within ..... *Ochroma pyramidale*
      3. Flowers yellow turning red with age, fruit not woolly within
         ..... *Taliparíti tilliaceum* var. *pernambucense*
   2. Leaf blades toothed 4
      4. Epicalyx bracteoles exceeding calyx ..... *Pavonia paniculata*
      4. Epicalyx bracteoles shorter than calyx or lacking 5
         5. Flowers red; staminal tube long-exerted; cultivated ..... *Hibiscus rosa-sinensis*
         5. Flowers yellow-orange or pink; staminal tube not exerted; not cultivated 6
            6. Leaves simple; narrowly ovate to elliptic..... *Sida acuta*
            6. Leaves simple to lobed; widely ovate or angulate ..... *Urena lobata*

172. **Hibiscus rosa-sinensis* L. var. *rosa-sinensis*, Sp. Pl. 694. 1753.

DISTRIBUTION.— Cultivated on Isla del Coco at the Wafer Bay ranger station. Native to tropical Asia but now widespread as an ornamental.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 199*.

173. *Ochroma pyramidale* (Cav. ex Lam.) Urb., Repert. Spec. Nov. Regni Veg. Beih. 5:123. 120.

O. lagopus Sw.

DISTRIBUTION.— Frequent on the rocky shores of the island. Native to the New World and pantropical in cultivation.

REMARKS.— The Cocos Island finch (*Pinaroloxias inornata*) has been observed drinking nectar from the flowers of *O. pyramidale* by the authors.

SPECIMENS EXAMINED.— CR: *Gómez 3274*; FTG: *Trusty 233*.

174. *Pavonia paniculata* Cav., Diss. 3:135, t. 46, f. 2. 1787.

DISTRIBUTION.— Found in the disturbed areas in Wafer Bay on Isla del Coco. Distributed from Mexico to Argentina and the Greater Antilles.

SPECIMENS EXAMINED.— GH: *Pittier 16243*.

175. **Sida acuta* Burm.f., Fl. Ind. 147. 1768.

DISTRIBUTION.— Infrequently found in cleared areas on Isla del Coco near housing of the Wafer Bay ranger station. Pantropical in distribution.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 81*.

176. *Talipariti tiliaceum* (L.) Fryxell var. *pernambucense* (Arruda) Fryxell, Contr. Univ. Michigan Herb. 23:262. 2001.

Hibiscus tiliaceus L.

DISTRIBUTION.— Forming dense stands on Isla del Coco near the bayshore and in abandoned agricultural areas in Wafer and Chatham Bays. Found from Mexico to Brazil; also the West Indies; occasionally cultivated.

SPECIMENS EXAMINED.— CR: *Gómez 3299*; *Gómez-Laurito 6953*; *Lépiz 361*; *Quesada 1110*; *Rojas 3713*; *Sánchez 7*; FTG: *Trusty 39*; *Trusty 221*; INB: *González 1191*; *Lépiz 361*; *Quesada 1110*; *Rojas 3713*; USJ: *Soto 3852*; *Soto s.n.*

177. **Theobroma cacao* L., Sp. Pl. 782. 1753.

DISTRIBUTION.— Persisting from cultivation on Isla del Coco. Found in the former agricultural area in Wafer Bay. Native to the New World tropics but cultivated worldwide.

REMARKS.— The fruits of *T. cacao* are eaten by the rats on the island (J. Trusty, pers. obs.).

SPECIMENS EXAMINED.— FTG: *Trusty 228*; *Trusty 493*.

178. **Urena lobata* L., Sp. Pl. 692. 1753.

DISTRIBUTION.— Common in disturbed and successional areas throughout Isla del Coco. A pantropical weed.

SPECIMENS EXAMINED.— CR: *Gómez 3303*; *González and Sierra 647*; FTG: *Trusty 131*; *Trusty 223*; *Trusty 442*; INB: *González 1206*; *Quesada 1122*; USJ: *Soto s.n.*

MARCGRAVIACEAE

179. ***Marcgravia wafer*i** Standl., Publ. Field Mus. Nat. Hist., Bot. ser. 18:698. 1937. (Fig. 13)

TYPE: *Svenson 327* (holotype: F).

Vine, leaves dimorphic, juvenile leaves small, rotund, appressed to object, adult leaves with short thick petiole, coriaceous, lamina lanceolate-oblong ca. 6.5 × 2.5 cm, apex acute to shortly obtuse acuminate, base obtuse to subrotund, coriaceous, nerves scarcely apparent on either side, costa prominent below; inflorescence short pedunculate, umbelliform, few-flowered, pedicels 1.5–2.5 cm long, flowers obliquely affixed; tubular bracts short sitpulate 1.5 cm long, apex rounded and barely expanded; sepals 3 mm long; fruits bright red, globular 1 cm diameter, apex with a small central depression; seeds minute, numerous.

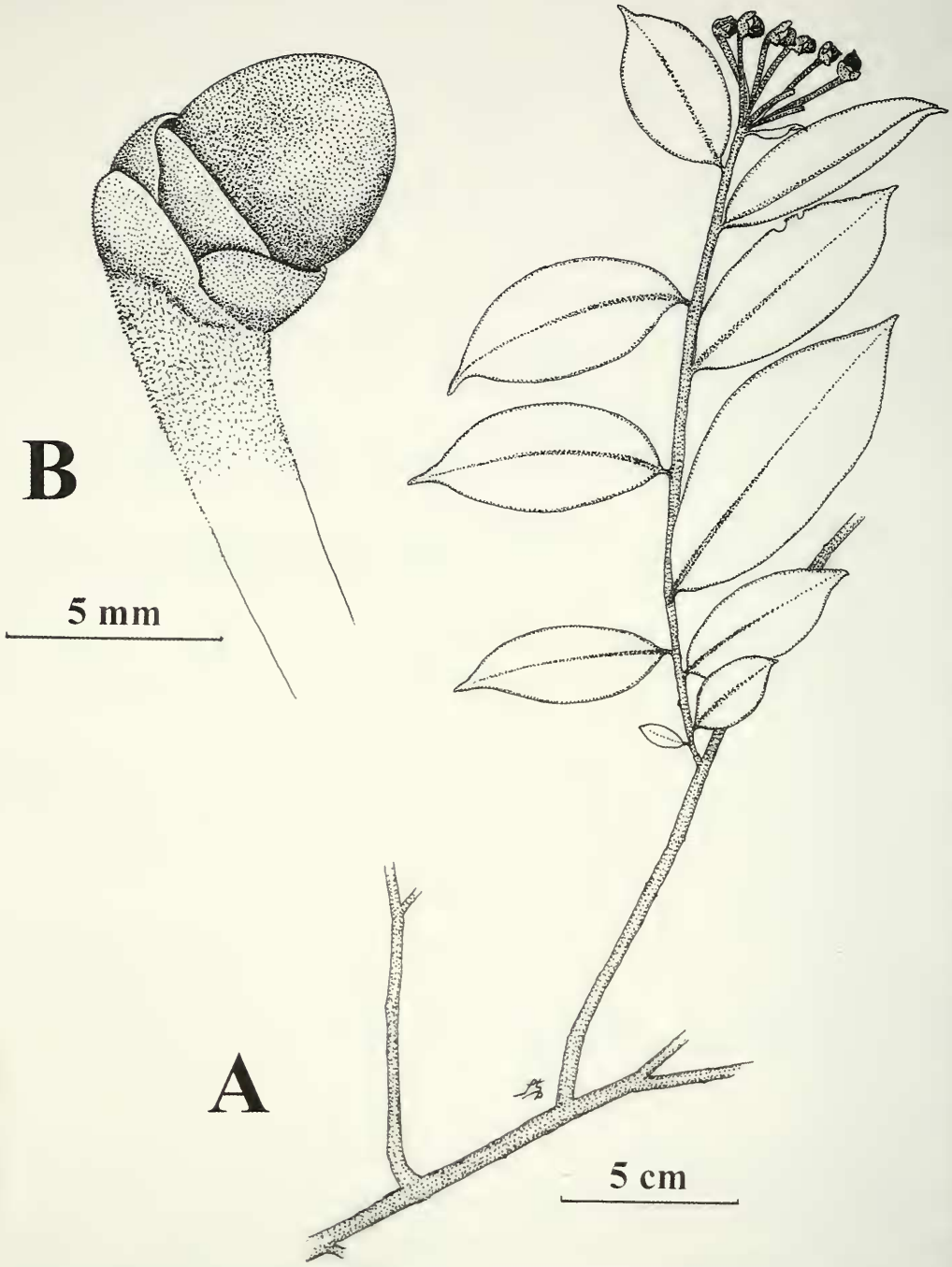

FIGURE 13. *Marcgravia waferi* (drawn from *Trusty 481*). A. Habit of plant showing terminal inflorescence. B. Single flower (stamens lacking) showing ovary.

DISTRIBUTION.— Common liana of the closed canopy forest from 50–600 msl. Endemic to Isla del Coco.

REMARKS.— This species was published under the name *M.* cf. *rectiflora* Triana & Planch. in Svenson (1935).

SPECIMENS EXAMINED.— CR: *Dauphin 1128*; *Foster 4127*; *Gómez 3261*; *Gómez-Laurito 6939*; *Gómez-Laurito 6947*; *González and Sierra 639*; *Jiménez 3190*; *Jiménez s.n.*; *Lépiz 330*; *Murawski 332*; *Murawski 347*; *Poveda s.n.*; *Rojas 3661*; *Sánchez 1*; *Valerio 1105*; FTG: *Trusty 57*; *Trusty 163*; *Trusty 481*; INB: *Dauphin 1128*; *Lépiz 330*; *Quesada 1012*; *Rojas 3661*; NY: *Foster 4127*; *Gómez 3261*; *Jiménez s.n.*; USJ: *Gómez-Laurito 6939*; *Lépiz 330*; *Soto s.n.*

MELASTOMATACEAE

1. Fruits loculicidal capsules; ovary superior ..... *Schwackaea cupheoides*
1. Fruits berries; ovary wholly or partly inferior 2
  2. Inflorescence lateral or axillary 3
    3. Hypanthium and calyx lobes together greater than 1.2 cm long 4
      4. Petals pubescent on both surfaces ..... *Henriettea succosa*
      4. Petals glabrous on both surfaces 5
        5. Mature leaves strigose to setose abaxially ..... *Henriettella fascicularis*
        5. Mature leaves glabrous on both surfaces ..... *Henriettella odorata*
    3. Hypanthium and calyx lobes together less than 1 cm long 6
      6. Petals obtuse or rounded 7
        7. Herb to 0.5 m tall ..... *Maieta poeppigii*
        7. Shrub over 1 m tall 8
          8. Flowers 4-merous; leaves glabrous ..... *Clidemia ombrophila*
          8. Flowers 5-merous; leaves strigose ..... *Clidemia strigillosa*
      6. Petals acute or acuminate 9
        9. Hypanthium densely hirsute ..... *Ossaea bracteata*
        9. Hypanthium glabrous ..... *Ossaea macrophylla*
  2. Inflorescence terminal 10
    10. Calyx calyptrate in bud, becoming completely detached by anthesis ..... *Conostegia lasiopoda*
    10. Calyx open in bud, the lobes present at anthesis 11
      11. Leaves green adaxially; rufous pubescent abaxially ..... *Miconia dodecandra*
      11. Leaves green on both sides 12
        12. Leaf base decurrent onto the petiole ..... *Miconia prasina*
        12. Leaf base not decurrent onto the petiole 13
          13. Shrub less than 0.5 m tall ..... *Miconia* sp. B
          13. Shrub or tree greater than 1 m tall ..... *Miconia* sp. A

180. *Clidemia ombrophila* Gleason, Brittonia 3:138–139. 1939.

DISTRIBUTION.— Frequent in the closed canopy forest throughout Isla del Coco from 200–500 msl. Distributed from Nicaragua to Panama.

SPECIMENS EXAMINED.— CR: *Quesada 1114*; FTG: *Trusty 187*; *Trusty 231*; INB: *Quesada 1114*; *Rojas 3779*; US: *Pittier 12373*.

181. *Clidemia strigillosa* (Sw.) DC., Prodr. 3:159. 1828.

C. umbonata DC.

DISTRIBUTION.— Common in full sun or in forest openings or edges from 50–450 msl on Isla del Coco. Distributed from southern Mexico to the Brazilian Amazon; also found in the Greater Antilles.

REMARKS.— This species was published under the name *C. novemnervia* (DC.) Triana in Svenson (1935) and *C. pustulata* DC. in Fosberg and Klawe (1966).

SPECIMENS EXAMINED.— *CR: Gómez 18048*; *Gómez 18057*; *Gómez 3264*; *Gómez-Laurito 6919*; *González 1154*; *Jiménez 3140*; *Jiménez 3149*; *Sánchez 12*; *Valerio 1104*; FTG: *Trusty 43*; *Trusty 284*; *Trusty 321*; *Trusty 445*; *Trusty 509*; GH: *Pittier 12391*; *Svenson 307*; INB: *González 1154*; *Lépiz 360*; *Quesada 1049*; *Quesada 1086*; US: *Gómez 3264*; *Holdridge 5166*.

182. *Conostegia lasiopoda* Benth., Bot. Voy. Sulphur 96. 1844.

DISTRIBUTION.— Frequent in closed forest riparian areas from 30–450 msl on Isla del Coco. Found in Nicaragua, Costa Rica, Panama, northern Colombia and Ecuador.

SPECIMENS EXAMINED.— CR: *Fournier 303*; *Gómez 3306*; *Gómez-Laurito 6923*; *Gómez-Laurito 6933*; *González 1200*; *Jiménez 3141*; *Jiménez 3148*; *Jiménez 3197*; *Lépiz 356*; *Quesada 1033*; *Quesada 1048*; *Rojas s.n.*; *Sánchez 16*; *Soto s.n.*; *Valerio 1103*; FTG: *Trusty 189*; *Trusty 309*; *Trusty 444*; *Trusty 472*; GH: *Howell 10183*; *Pittier 12372*; *Pittier 16221*; *Snodgrass and Heller 963*; INB: *González 1166*; *González 1200*; *Lépiz 356*; *Quesada 1033*; *Quesada 1048*; *Rojas 3576*; USJ: *Soto s.n.*

183. *Henriettea succosa* (Aubl.) DC., Prodr. 3:178. 1828.

DISTRIBUTION.— Common subcanopy tree in closed canopy forest from 30–250 msl on Isla del Coco. Distributed from southern Mexico to the Guianas and eastern Brazil; also Trinidad and Tobago.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Gómez 18040*; *Gómez-Laurito 6925*; *Gómez-Laurito 6926*; *González 1160*; *Jiménez s.n.*; *Lépiz 373*; *Rojas 3655*; *Soto s.n.*; FTG: *Trusty 140*; *Trusty 172*; *Trusty 311*; *Trusty 566*; INB: *González 1160*; *Lépiz 373*; *Rojas 3655*; USJ: *Lépiz 373*.

184. *Henriettella fascicularis* (Sw.) C. Wright in Sauvalle, Anales Acad. Ci. Med. Habana 5:435. 1869.

DISTRIBUTION.— Very common subcanopy tree in closed canopy forest from 30–450 msl throughout Isla del Coco. Distributed from Belize to Panama; also found in the Greater Antilles.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Fournier 304*; *González 1204*; *Jiménez 3152*; FTG: *Trusty 349*; INB: *González 1204*.

185. *Henriettella odorata* Markgr., Notizbl. Bot. Gart. Berlin-Dahlem 15(3):380–381. 1941.

DISTRIBUTION.— Infrequent in riparian areas along the northern part of Isla del Coco. Found in Nicaragua, Costa Rica and Ecuador.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 521*; *Trusty 546*.

186. *Maieta poeppigii* Mart. ex Cogn., Mart., Fl. Bras. 14(4):464, pl. 99. 1888.

DISTRIBUTION.— Common in closed forest from 150–450 msl throughout Isla del Coco. Distributed from Colombia and Venezuela to Peru, Brazil and the Guianas.

REMARKS.— This species commonly has ant associations in continental areas. No ant-plant interactions have been studied for the Cocos Island populations.

SPECIMENS EXAMINED.— CR: *Dauphin 1174*; *Fournier 353*; *Rojas 3633*; *Soto s.n.*; FTG: *Trusty*

63; *Trusty 506*; GH: *Foster 4122*; *Pittier 12374*; *Pittier 16225*; *Svenson 401*; INB: *González 1170*; *Rojas 3633*; US: *Foster 4122*; *Holdridge s.n.*; *Pittier 12374*.

187. ***Miconia* sp. B**

DISTRIBUTION.— Infrequently found in closed canopy forest from 50–400 msl. Endemic to Isla del Coco.

REMARKS.— First report for Isla del Coco. Dr. Frank Almeda and Ricardo Kriebel will be publishing the name and description of this species.

SPECIMENS EXAMINED.— FTG: *Trusty 68*.

188. *Miconia dodecandra* Cogn., Mart., Fl. Bras. 14(4):243. 1887.

DISTRIBUTION.— Very common subcanopy tree species on Isla del Coco from 150–530 msl; forms extensive groves in the area of Cabo Atrevido. Distributed from southern Mexico through Central America to Bolivia and Southern Brazil; also the Greater Antilles, Dominica, and Trinidad.

SPECIMENS EXAMINED.— CR: *Dauphin 1160*; *Gómez 18051*; *Quesada 1108*; *Rojas 3624*; FTG: *Trusty 60*; *Trusty 406*; *Trusty 479*; GH: *Foster 4124*; *Pittier 16223*; INB: *González 1185*; *Lépiz 329*; *Quesada 1108*; US: *Holdridge 5179*.

189. *Miconia prasina* (Sw.) DC., Prodr. 3:188. 1828.

M. pteropoda Benth.; *M. attenuata* DC.

DISTRIBUTION.— Frequent throughout the island from 50–450 msl on Isla del Coco. Distributed from southern Mexico to Bolivia and Paraguay; also in the West Indies.

SPECIMENS EXAMINED.— BKL: *Svenson 303*; CR: *Gómez 3262*; FTG: *Trusty 384*; *Trusty 470*; *Trusty 519*; USJ: *Soto s.n.*

190. ***Miconia* sp. A**

DISTRIBUTION.— Rare; found on Cerro Iglesias and also on ridge tops near Iglesias Bay. Endemic to Isla del Coco.

REMARKS.— First report for Isla del Coco. Dr. Frank Almeda and Ricardo Kriebel will be publishing the name and description of this species.

SPECIMENS EXAMINED.— FTG: *Trusty 270*; *Trusty 557*.

191. *Ossaea bracteata* Triana, Trans. Linn. Soc. London 28:147. 1871.

DISTRIBUTION.— Common throughout Isla del Coco from 0–550 msl. Found on Isla del Coco and from Panama to Colombia and Ecuador.

SPECIMENS EXAMINED.— FTG: *Trusty 66*; *Trusty 119*; *Trusty 285*; *Trusty 331*; *Trusty 384*; GH: *Foster 4168*; INB: *González 1179*; *Quesada 1118*; *Rojas 3694*; US: *Foster 4168*.

192. *Ossaea macrophylla* (Benth.) Cogn in A. & C.DC., Monogr. Phan. 7:1064. 1891.

DISTRIBUTION.— Common throughout Isla del Coco from 0–550 msl. Distributed from Nicaragua to Colombia and Ecuador.

REMARKS.— This taxon was originally described from Isla del Coco.

SPECIMENS EXAMINED.— CR: *Dauphin 1165*; *Dressler 4472*; *Fournier 340*; *González 1141*; *González 1182*; *Lépiz 357*; *Quesada 1006*; *Rojas 3575*; *Sánchez 15*; *Soto s.n.*; FTG: *Trusty 33*; *Trusty 122*; *Trusty 251*; *Trusty 316*; *Trusty 367*; GH: *Foster 4128*; *Pittier 12381*; *Pittier 16224*; *Snodgrass and Heller 951*; INB: *González 1141*; *González 1182*; *Lépiz 357*; *Quesada 1006*; *Rojas 3575*; US: *Barclay s.n.*; *Foster 4128*; *Gómez 3302*; *Holdridge 5171*; *Jiménez 3161*; *Klawe 1550*; *Pittier 12381*.

193. *Schwackaea cupheoides* (Benth.) Cogn. in T. Durand, Index. Gen. Phan. 132. 1888.

DISTRIBUTION.— Unknown on Isla del Coco. Distributed from southern Mexico to Panama and Colombia.

REMARKS.— This species may be extinct on Isla del Coco. There is a single collection by Crossland made in 1924.

SPECIMENS EXAMINED.— BM: *Crossland 454* (not seen).

MELIACEAE

194. *Guarea glabra* Vahl, Eclog. Amer., 3:8. 1807.

DISTRIBUTION.— Locally common on Isla del Coco in Los Llanos (200–300 msl). Distributed from Mexico to Colombia, Venezuela and Ecuador; also occurs in the West Indies.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 208*; *Trusty 242*; *Trusty 547*; INB: *Rojas 3657*.

MORACEAE

1. Leaves lobed . . . . . *Artocarpus altilis*
1. Leaves not lobed 2
   2. Stipules scars completely encircling the stem . . . . . *Ficus pertusa*
   2. Stipule scars small, linear . . . . . *Brosimum* sp.

195. **Artocarpus altilis* (Parkinson ex Z.) Fosberg, J. Wash. Acad. Sci 31:95. 1941.

DISTRIBUTION.— Infrequent along the coast of Isla del Coco. Probably native to Malenesia but widely cultivated throughout the tropics of the world.

REMARKS.— These plants are apparently persisting from an early introduction or have naturalized onto Isla del Coco. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 226*.

196. *Brosimum* sp.

DISTRIBUTION.— Frequent as the largest canopy tree on Isla del Coco. More common in the northern part of the island near Cabo Atrevido.

REMARKS.— The identity of this species could not be determined. Additional collections in flower or fruit are needed to clarify its identity.

SPECIMENS EXAMINED.— BKL: *Svenson 337*.

197. *Ficus pertusa* L.f., Suppl. Pl. 442. 1781 [1782].

DISTRIBUTION.— Infrequently found on Isla del Coco near the Genio River in Wafer Bay. Distributed from Mexico to Paraguay; also occurs in the West Indies.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Quesada 1069*; INB: *Quesada 1069*.

MUNTINGIACEAE

198. *Muntingia calabura* L. Sp. Pl. 509. 1753.

DISTRIBUTION.— Found near the beach edge in Wafer Bay on Isla del Coco. Widely distributed in tropical America in secondary forests.

SPECIMENS EXAMINED.— USJ: *Gómez-Laurito 6905* (not seen).

MUSACEAE

199. **Musa X paradisiaca* L., Sp. Pl. 1043. 1753.

DISTRIBUTION.— Cultivated on Isla del Coco in Chatham and Wafer Bays. Cultivated in tropical areas around the world.

SPECIMENS EXAMINED.— Not collected.

MYRSINACEAE

1. Flowers terminal, paniculate. . . . . *Ardisia cuspidata*
1. Flowers ramiflorous, simple . . . . . *Myrsine pellucidopunctata*

200. ***Ardisia cuspidata*** Benth., Bot. Voy. Sulphur. 123. 1844. (Fig. 14)

TYPE: *Hinds s.n.* (holotype: BM).

Shrub to trees 1–7 m tall; branchlets slender, angulate, 2–4 mm in diam., with densely, minute furfuraceous-lepidote scales at least apically, usually glabrescent with age; leaves: with blades membranaceous, elliptic to obovate, 2.7–11.1 × 2.3–4.5 cm, apically acuminate, with an acumen 5–12 mm, basally obtuse, decurrent on the petiole to the base, conspicuously and prominently punctate and punctate-lineate, essentially glabrous above, scattered to densely, minute furfuraceous-lepidote scales below, denser along the midrib, the secondary veins 18–26 pairs, the margins entire, flat; petioles slender, marginate, 3–8 mm, glabrous above, densely, minute furfuraceous-lepidote scales below; inflorescences lateral and terminal, erect, pinnately to tripinnately paniculate, 3–7 × 3–6 cm, pyramidal, shorter than the leaves, densely, minute furfuraceous-lepidote scales, the branches loosely congested into 3–7-flowered corymbs; peduncles 5–20 mm; inflorescence branch bracts unknown, early caducous; floral bracts caducous, membranaceous, ovate to oblong, 0.5–1.2 × 0.2–0.8 mm, apically acute, prominently punctate and punctate-lineate, glabrous, the margins irregular, minutely erose, hyaline; pedicels slender, 3.5–5 mm, prominently punctate and punctate-lineate, scattered, minute furfuraceous-lepidote scales; flowers 5-merous; calyx 1.4–1.6 mm, the tube 0.1–0.3 mm, the lobes ovate, 1.1–1.3 × 0.8–1 mm, apically acute, conspicuously and prominently punctate and punctate-lineate, glabrous within, sparsely, minute furfuraceous-lepidote scales outside, the margins entire, minutely erose, hyaline; corolla 3.3–3.5 mm, the tube 0.9–1.1 mm, the lobes lanceolate, 2.3–2.6 × 1.1–1.4 mm, apically acute, prominently punctate and punctate-lineate, glabrous, the margins entire; stamens 2.5–2.7 mm, the filaments 1.1–1.3 mm, the staminal tube 0.5–0.6 mm, the apically free portion 0.6–0.8 mm, prominently punctate and punctate-lineate, glabrous, the anthers ovate to lanceolate, 1.4–1.6 × 0.5–0.7 mm, apically apiculate, basally subcordate, the connective conspicuously punctate; pistil 4–4.4 mm, glabrous, the ovary ovate, 1–1.2 mm, the styles 2.9–3.2 mm, prominently punctate and punctate-lineate, the ovules 37–43; fruits globose, 3.5–4.5 mm in diam., conspicuously and prominently punctate and punctate-lineate, glabrous.

DISTRIBUTION.— Common in closed canopy forest and riparian areas throughout the island from 50–450 msl. Endemic to Isla del Coco.

REMARKS.— This species, previously recombined as *Icacorea cuspidata* (Benth.) Lundell, is recognized as a species of *Ardisia* by Rickertson and Pipoly (in prep.). This species was published under the name *A. compressa* Kunth in Svenson (1935) and Fosberg and Klawe (1966).

SPECIMENS EXAMINED.— FTG: *Trusty 64*; *Trusty 177*; *Trusty 209*; *Trusty 247*; *Trusty 304*; *Trusty 313*; *Trusty 373*; *Trusty 405*; *Trusty 478*; *Trusty 516*; *Trusty 540*; INB: *Lépiz 335*; *Lépiz 349*; *Lépiz 378*; *Rojas 3670*.

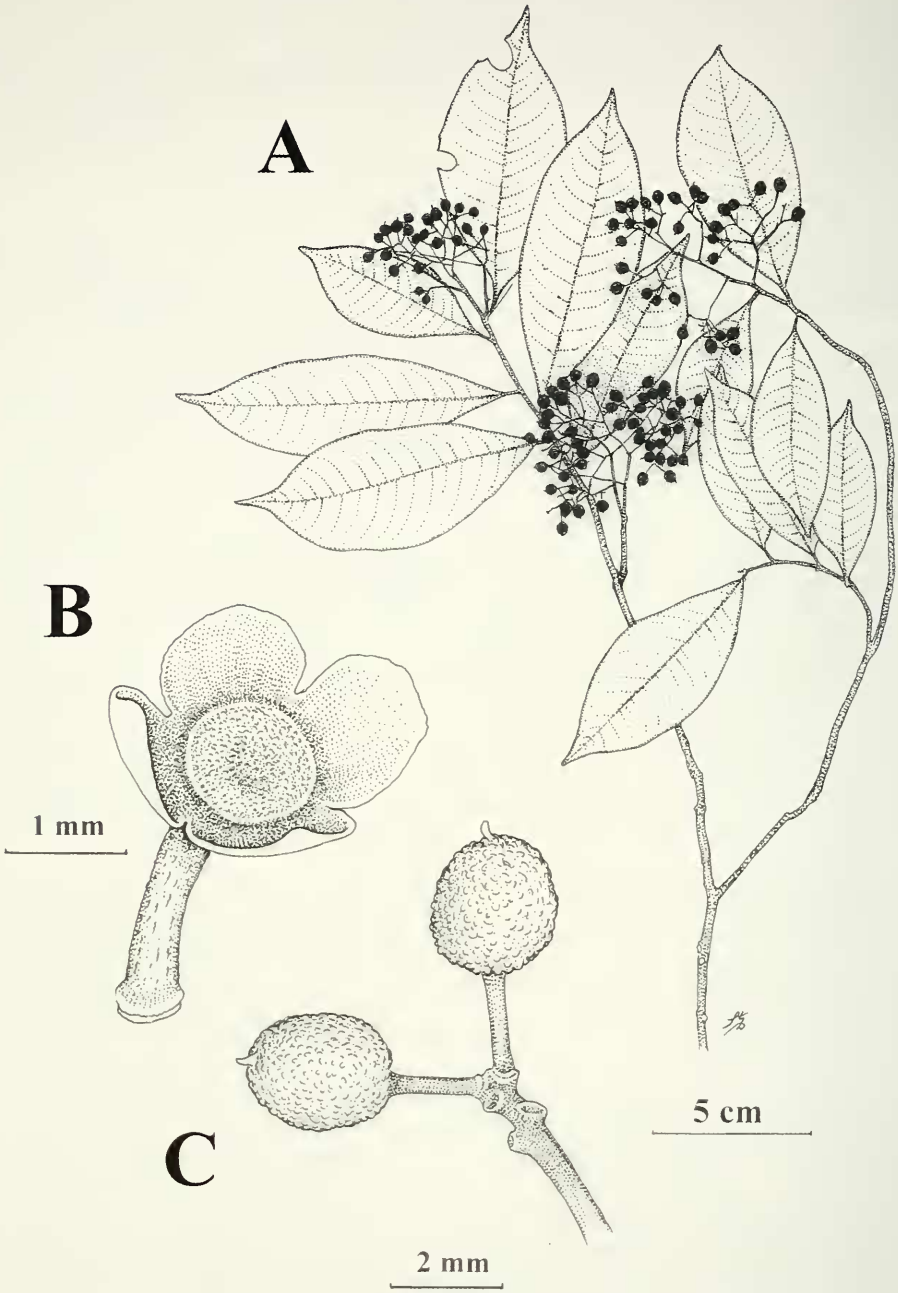

FIGURE 14. *Ardisia cuspidata* (drawn from *Trusty 209*). A. Branch of plant showing infructescences. B. Calyx of flower. C. Fruits showing punctations.

201. *Myrsine pellucidopunctata* Oerst., Vidensk. Meddel. Dansk. Naturhist. Føren. Kjøbenhavn 1861:133. 1861.

DISTRIBUTION.— Infrequent in the upper elevations (350–630 msl) of Isla del Coco. Distributed from Costa Rica to Colombia.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Rojas 3693*; FTG: *Trusty 538*; INB: *Rojas 3693*.

MYRTACEAE

1. Ovules numerous, seeds many . . . . . *Psidium guajava*
1. Ovules few; seeds 1 or 2 2
   2. Leaves greater than 2.5 cm wide . . . . . *Eugenia pacifica*
   2. Leaves less than 2 cm wide . . . . . *Eugenia cocosensis*

202. ***Eugenia cocosensis*** Barrie, Novon 15(1):11–12. 2005.

TYPE: *Foster 4129* (holotype: CR; isotypes: CAS, F, MO)

Small trees of shrubs, 4–5 m; buds, inflorescences, and emergent leaves thinly appressed-pubescent with cinereous or pale coppery, dibrachiate hairs, 0.2 mm long; branchlets compressed; bark reddish, glabrate. Leaves lanceloate or ovate, the blades 3.5–5 × 1–2 cm, 2.5–4 times as long as wide, coreiaceous, drying a concolorous olive, the petioles and midveins reddish; midvein impressed above, reased below; lateral veins 4 to 6, straight, obscure on the upper surface; marginal veins similar to the laterals and arched between them, 1–2 mm from the margins; both surfaces glabrate; glands numerous, conspicuous, usually strongly rounded; margins revolute near the base, decurrent into the inner edge of the petiole; apex acuminate; petioles 2–3 mm long, channeled dorsally, glabrate. Inflorescences axillary, racemose, solitary, appressed-pubescent with pale coppery, dibrachiate hairs; axis 1–3 mm long; flowers 2–6; bracts 0.5 mm long, persistent, ovate, the margins scarious, the apex acute; buds 2 mm long, turbinate. Flowers pedicellate, the pedicels 2 mm long, appressed-pubescent; bracteoles fused, forming an involucre 1 mm diam. dilated at anthesis, appressed pubescent on the outer surface only, the margins scarious, the apex rouned; hypanthium 1 mm long, obconic, appressed pubescent; calyx lobes in unequal pairs, 0.5–1 × 1 mm, elliptic, appressed pubescent on the outer surface, the margins scarious-ciliate, the apex rounded; petals 1 × 1 mm, ovate, the margins entire, the apex bluntly acute; disk ca. 1 mm diam., glabrous; stamens 25–30, 1 mm long; style 1.5 mm long, glabrous. Fruits 9–10 × 7–8 mm, widely ellipsoid or obovoid; pericarp think-walled, glabrous, glandular; calyx persistent, erect but inconspicuous; immature fruit orange, maturing to black.

DISTRIBUTION.— Infrequent or locally common in the closed canopy forest throughout Isla del Coco. Endemic to Isla del Coco.

REMARKS.— Barrie (2005) states that the leaf blades of *E. cocosensis* are half the size of *E. pacifica* Benth. with the petioles one third as long, the flowers are half as large and the fruits are shorter and wider. We were able to collect immature fruits of this species which were orange in color, drying black.

Specimens examined.—CR: *Quesada 1071*; FTG: *Trusty 138*; *Trusty 550;* INB: *Lépiz 345*; *Quesada 1071*

203. ***Eugenia pacifica*** Benth., Bot. Voy. Sulphur 98. 1844.

TYPE: *Barclay 2182* (holotype: BM, isotype: K!)

Shrub or tree 8 m tall. Branchlets puberlulent or almost glabrous; leaves short-petiolate, ovate, 5 cm long and 2.5 cm wide, subacuminate, cuneate, subcoriaceaous, glossy above, glabrous; peti-

oles 6–10 mm long; peduncles axillary, very short, few flowered; flowers unknown; berries black, oblong, 10–13 mm long and 4–6 mm wide.

Distribution.— Infrequent in closed canopy forest 50–250 m on the island. Endemic to Isla del Coco.

Specimens examined.— CR: *Pittier 16247*; FTG: *Trusty 343*; *Trusty 542*; K: *Barclay 2182*.

204. **Psidium guajava* L., Sp. Pl. 470. 1753.

Distribution.— Apparently has not persisted on Isla del Coco. Cultivated throughout the tropics.

Remarks.— This species is not currently in cultivation on the island. This species should not be cultivated on the island as it is an invasive pest plant in many island ecosystems (Pacific Island Ecosystems at Risk 2002).

Specimens examined.— GH: *Howell 10184B*; USJ: *Gómez 3383*.

Onagraceae

205. *Ludwigia hyssopifolia* (G. Don) Exell, Garcia de Orta 5:471. 1957.

Jussiaea linifolia Vahl

Distribution.— Common on Isla del Coco in disturbed or cleared areas near Chatham and Wafer Bays. Pantropical in distribution.

Remarks.— *L. hyssopifolia* is considered native here due to the early collections but is probably introduced to the island.

Specimens examined.— FTG: *Trusty 113*; *Trusty 132*; *Trusty 457*; INB: *Quesada 1057*.

Orchidaceae

1. Pseudobulbs present . . . . . *Maxillaria parviflora*
1. Pseudobulbs absent 2
    2. Plants erect; flowers axillary . . . . . *Maxillaria adendrobium*
    2. Plants pendent; flowers terminal 3
        3. Leaves greater than 6 cm long, inflorescence of 3–4 flowers . . . *Epidendrum cocoënse*
        3. Leaves less than 6 cm long, inflorescence of 1–2 flowers 4
            4. Leaves 6–8 cm long; flowers white . . . . . *Epidendrum jimenezii*
            4. Leaves less than 6 cm; flowers green-yellow . . . . . *Epidendrum insulanum*

206. ***Epidendrum cocoënse*** Hágsater, Icon. Orchid. (Mexico) 3:pl. 325. 1999.

Type: *Svenson 333* (holotype: AMES; isotype: AMES, BKL!)

Pendent, branching epiphytic herb to 80 cm in length. Roots only at base, 1–2 cm in width. Stems successive, produced from a subapical internode of the previous stem, there is no main stem as such, all flowering apically, 15–30 × 0.5–0.7 cm. Leaves alternate, evenly distributed throughout each stem, articulate, narrowly elliptic-lanceolate to ligulate, obtuse, subcoriaceous, up to 2.7 cm in length. Inflorescence apical, flowering only once, 5–6 cm long. Flowers 3–4, apparently successive, distichous, cream colored. Floral bracts slightly longer than the ovary, ovate, conduplicate, imbricate, 19–29 × 15–18 mm. Ovary not inflated, round, 19 × 3 mm. Sepals ovate-elliptic to ovate-lanceolate, acute, 7-veined. Petals narrowly elliptic-oblanceolate, acute, 5-veined, 10–11 × 2.5 mm. Lip entire, cordiform, elongate, 9.5 × 7 mm; callus "Y"-shaped. Column straight, short, 5.5 mm. Clinandrium reduced, erose. Capsule pyriform 28 × 12 mm with an apical neck ca. 7 mm.

Distribution.— Common from 0 to 500 msl throughout the island. Endemic to Isla del Coco.

REMARKS.— This species was published under the name *E. imbricatum* Lindl. in Svenson (1935) and Fosberg and Klawe (1966).

SPECIMENS EXAMINED.— BKL: *Svenson 333*; *Svenson 348*; CR: *Dressler 4471*; *Gómez 3270*; *Gómez-Laurito 6914*; *Valerio 1108*; FTG: *Trusty 101*; *Trusty 167*; *Trusty 176*; *Trusty 184*; *Trusty 194*; *Trusty 195*; *Trusty 363*; *Trusty 387*; *Trusty 461*; *Trusty 483*; *Trusty 494*; *Trusty 496*; *Trusty 501*; *Trusty 510*; *Trusty 511*; *Trusty 512*; *Trusty 520*; *Trusty 544*; *Trusty 548*; *Trusty 560*; *Trusty 561*; INB: *Lépiz 339*; *Rojas 3691*; USJ: *Dressler 4471*; *Gómez 3270*; *Gómez-Laurito 6914*; *Rojas 3691*; *Sánchez 10*.

207. ***Epidendrum insulanum*** Schltr., Beih. Bot. Centralbl. 36:404. 1918. (Fig. 15)

TYPE: *Pittier 16350* (holotype: CR; isotype: GH!).

Pendent epiphyte, 30–60 cm or more. Stems ramified, 5–15 cm, the secondary stems shorter, Leaves long lanceolate, bilobed, those on the principle stem 4.1–5.4 × 0.7–0.9 cm, more or less equal except the basal leaves are smallest, the leaves of the secondary stems 1.7–4.0 × 0.6–0.7 cm, unequal. Inflorescence terminal, simple, flowering only once for each stem; floral bract shorter than the ovary, ca. 10 mm. Flowers one, carnose, resupinate, greenish-yellow, cerose; sepals spreading, 8–10 × 2.5–3.0 mm, ligulate-obovate, obtuse; petals spreading, 7–9 × 1.7 mm, obovate-ligulate, rounded; lip 6.5 × 4.5 mm, ovate, the base rounded, the apex obtuse; callous triangular; column erect, ca. 4 mm, thick; clinandrium truncate, toothed; ovary subsessile, glabrous ca. 7 mm long.

DISTRIBUTION.— Frequent throughout the island from 200–500 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— BKL: *Svenson 335*; CR: *Gómez-Laurito 6924*; FTG: *Trusty 53*; *Trusty 158*; *Trusty 218*; *Trusty 500*; GH: *Agassiz s.n.*; *Pittier 16350*; *Svenson s.n.*; INB: *Rojas 3660*; US: *Foster 4117*; *Klawe s.n.*; USJ: *Gómez-Laurito 6924*; *Soto s.n.*

208. ***Epidendrum jimenezii*** Hágsater, Icon. Orchid. (Mexico) 3:pl. 341. 1999.

TYPE: *Jiménez 3178* (holotype: F, isotype: CR, MO, PMA!, SEL, U, USJ!).

Epiphytic, pendent herb to 100 cm or more in length. Roots from the basal nodes of the main stems, 1.5 mm in width. Stems branching, cane-line, straight, somewhat laterally flattened up to 75 cm in lenth, the secondary flowering stems, short to 12 cm lenth, but producing a new extension from the apex. Leaves numerous, distributed throughout the stems, blade narrowly lanceolate 2.1 × 0.5 cm, apex bilobed, subcoreiaceous, those of the main stem similar except for the basal ones which are smaller, those of the branches unequal, progressively larger, except for the last one which is often reduced. Inflorescence apical, from the secondary stems, flowers only once, 3 cm in length, the base enveloped in a foliose sheath which is smaller than the leaves. Floral bract conduplicate, shorter than the ovary 11–21 mm long. Flowers 1–2, white. Ovary slightly inflated ventrally towards the middle, 10–14 mm long. Sepals partly spreading, free, narrowly ligulate-obovate, acute, with a prominent apical keel on the laterals, 11 veined, 8–10 × 2.5–3.0 mm. Petals spreading, ligulate, slightly dilated towards the apical half, obtuse, 3-veined, 9.5–10 × 1.6 mm. Lip entire, cordiform, obtuse, mucronate, 5.5 × 3.6 mm; callus "Y"-shaped, ending in a central keel. Column straight, 5 mm long. Clinandrium reduced, sinuose, with a short tooth on each side. Nectary prominent, penetrating more tha half the ovary, inflated towards the end. Capsule ovoid, 12 × 8 mm pyramidal, without pedicel, with a short apical neck 6 mm long.

DISTRIBUTION.— Rare; found at below 100 msl near Wafer Bay. Endemic to Isla del Coco.

REMARKS.— We were unable to locate an herbarium specimen of this species. From the photos viewed; we were unable to distinguish this species from *E. insulanum*. It is possible that this species is a hybrid between *E. cocoënse* and *E. insulanum*; although the type has white flowers, the collection listed in the protologue (*Dressler 4468*) states that this collection has green flowers, not white as in the species description.

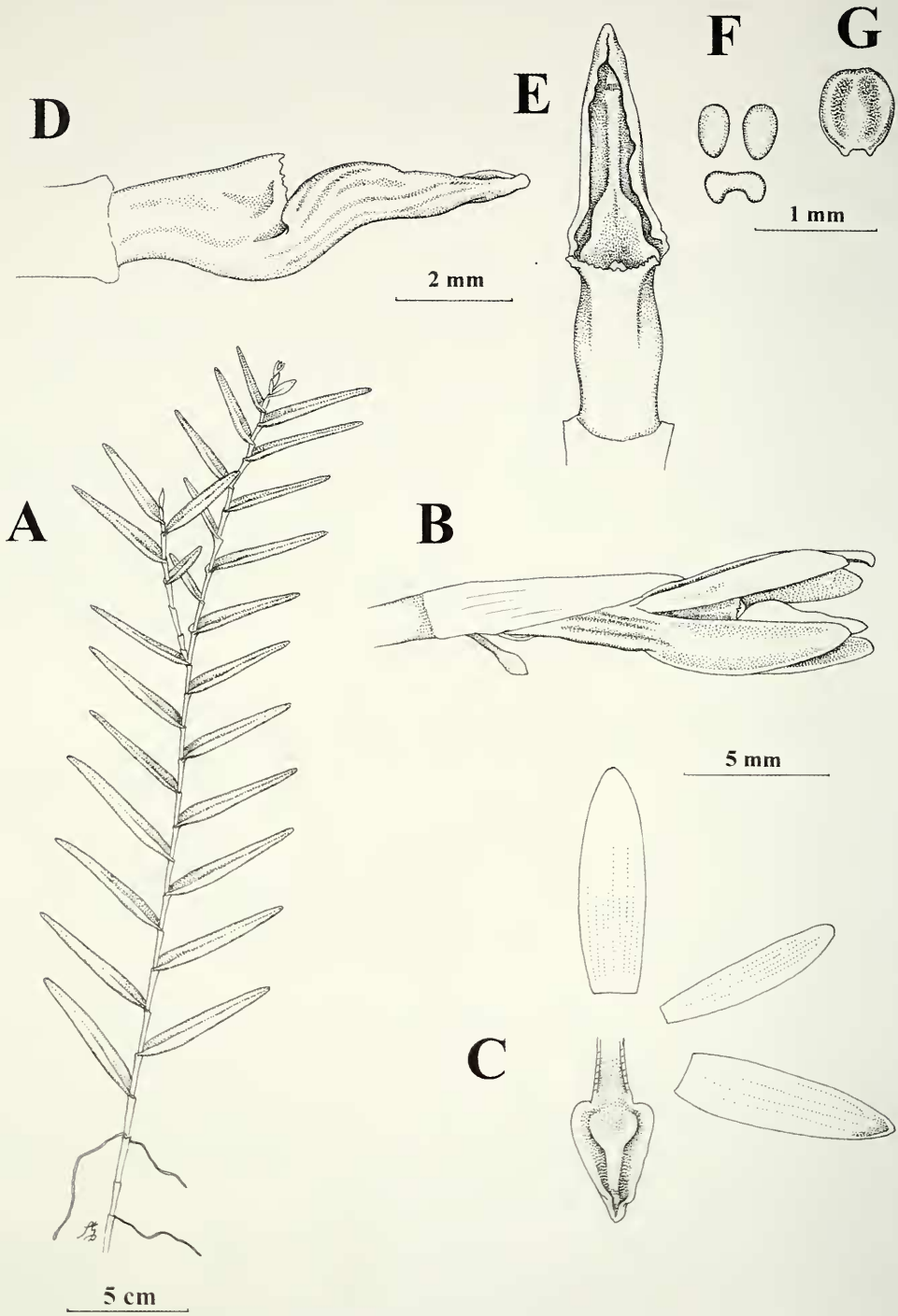

FIGURE 15. *Epidendrum insulanum* (drawn from *Trusty 53*). A. Habit of plant showing terminal inflorescence. B. Lateral view of flower. C. Diagram of flower showing petals, sepals and lip. D. Lateral view of column with attached lip. E. Ventral view of column and lip. F. Pollinia in relation to the stigmatic surface. G. Close up of pollinia.

SPECIMENS EXAMINED.— FLAS: *Dressler 4468* (photo); PMA: *Dressler 4468* (photo); *Jiménez 3178* (photo); USJ: *Jiménez 3178* (photo).

209. *Maxillaria adendrobium* (Rchb. f.) Dressler, Taxon, 13:248–249. 1964.

DISTRIBUTION.— Frequent from 300 to 630 msl throughout Isla del Coco. Distributed in Costa Rica, Panama and Ecuador; also the Dominican Republic.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 52*; *Trusty 100*; *Trusty 157*; *Trusty 495*; *Trusty 515*; *Trusty 556*; *Trusty 564*; INB: *Rojas 3692*.

210. *Maxillaria parviflora* (Poepp. & Endl.) Garay, Bot. Mus. Leafl. 21: 258. 1967.

DISTRIBUTION.— Common from 30–450 msl throughout Isla del Coco. Distributed from southern Florida, southern Mexico and Honduras to Ecuador, Peru and Brazil; also the Antilles.

REMARKS.— First report for Isla del Coco. This species was published under the name *Ornithidium* sp. aff. *stenophyllum* Schltr. in Svenson (1935) and Fosberg and Klawe (1966).

SPECIMENS EXAMINED.— CR: *Dauphin 1175*; *Gómez 18043*; *Valerio 1086*; *Valerio 1106*; FTG: *Trusty 104*; *Trusty 156*; *Trusty 244*; *Trusty 482*; *Trusty 504*; INB: *Quesada 1081*; *Rojas 3659*; USJ: *Dauphin 1175*; *Soto s.n.*

PASSIFLORACEAE

211. **Passiflora edulis* Sims f. *flavicarpa* O. Deg., Fl. Hawaii. 250. 1932.

DISTRIBUTION.— Cultivated on Isla del Coco in Wafer Bay. Native to Brazil but cultivated widely in tropical America.

REMARKS.— This species is considered an invasive exotic in many island ecosystems (Staples et al. 2000, Space et al. 2003), and we recommend its removal. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 485*.

PHYLLANTHACEAE

212. **Phyllanthus urinaria* L., Sp. Pl. 982. 1753.

DISTRIBUTION.— Common in cleared areas on Isla del Coco. Native to tropical Asia but widely introduced throughout tropical America.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 73*; INB: *González 1194*; *Quesada 1039*.

PHYTOLACCACEAE

213. *Phytolacca rivinoides* Kunth & C. D. Bouché, Index Sem. (Berlin) 15. 1849.

DISTRIBUTION.— Frequent in full sun near trails or riparian margins on Isla del Coco. Distributed from Mexico to Boliva and the West Indies.

REMARKS.— This species was published under the name *P. icosandra* L. in Stewart (1912), Svenson (1935) and Fosberg and Klawe (1966).

SPECIMENS EXAMINED.— BKL: *Svenson 405*; CR: *L. Gonzalez 660*; *Quesada 1062*; *Rojas 3675*; FTG: *Trusty 32*; *Trusty 471*; INB: *Quesada 1062*; *Rojas 3675*; USJ: *Soto s.n.*

PIPERACEAE

214. *Peperomia glabella* (Sw.) A. Dietr., Sp. Pl. 1:156. 1831.

P. nigropunctata Miq.

DISTRIBUTION.— Common throughout Isla del Coco from 50 to 630 msl. Distributed from Guatemala to Colombia, Venezuela, the Guianas and Brazil; also occurs in the West Indies.

SPECIMENS EXAMINED.— CR: *Dauphin 1164*; *Gómez 3271*; *Lépiz 362*; *Murawski 301*; *Murawski 325*; *Rojas 3638*; *Valerio s.u.*; FTG: *Trusty 62*; *Trusty 186*; INB: *Lépiz 362*; *Quesada 1028*; *Rojas 3638*; USJ: *Soto 3861*.

PLANTAGINACEAE

215. **Scoparia dulcis* L., Sp. Pl. 116. 1753.

DISTRIBUTION.— Infrequent on Isla del Coco in the cleared areas along the trail edge between Chatham and Wafer Bays. Distributed from the southern United States throughout subtropical and tropical America; also found in the Old World tropics.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Rojas 3688*; FTG: *Trusty 114*; *Trusty 541*; INB: *González 1215*; *Rojas 3688*.

POACEAE

1. Inflorescence a solitary spike or a solitary spikelike raceme or panicle 2
    2. Inflorescence lacking conspicuous, threadlike awns or bristles . . . . . *Paspalum decumbens*
    2. Inflorescence with conspicuous, threadlike bristles or awns 3
        3. Spikelet subtended by awns . . . . . *Ischaemum rugosum*
        3. Spikelet subtended by bristles 4
            4. Inflorescence a true spike, spikelets sessile, enclosed in burs subtended by a ring of retrorsely barbed bristles . . . . . *Cenchrus brownii*
            4. Inflorescence a spikelike panicle; spikelets subtended by a few, antrorsely barbed bristles . . . . . *Setaria parviflora*
1. Inflorescence paniculate or more than one raceme 5
    5. Foliar lamina with pseudopetioles, 5 mm long or longer. . . . . *Pharus latifolius*
    5. Foliar lamina lacking pseudopetioles 6
        6. Spikelets disarticulating above the glumes, generally breaking into separate florets or remaining intact until the expulsion of the seeds; empty glumes remaining adherent to the pedicel as visible bracts 7
            7. Spikelets with one floret, without additional rudimentary florets . . . . . *Sporobolus indicus*
            7. Spikelets with two or more florets 8
                8. Spikelets with 1 basal bisexual floret and 1 reduced rudimentary florets above; found mainly on the islets . . . . . *Chloris paniculata*
                8. Spikelets with many similar bisexual florets 9
                9. Spikelets sessile . . . . . *Eleusine indica*
                9. Spikelets pedicelate . . . . . *Eragrostis ciliaris*
        6. Spikelets disarticulated below the glumes; no glumes remain adherent to the pedicel 10
            10. Spikelets compressed laterally . . . . . *Melinis minutiflora*
            10. Spikelets compressed dorsally 11
                11. Inflorescence of paired or digitate spikes or racemes or racemes clustered very near the apex of the peduncle 12
                12. Spikelets 2 or more at each node of the rachis . . . . . *Digitaria setigera* var. *setigera*

12. Spikelets solitary at each node of the rachis. 13
13. Spikelets 2 or more times as long as broad, acute at apex . . . . . *Axonopus compressus*
13. Spikelets less than 2 times as long as broad, usually rounded or blunt . . . . . *Paspalum conjugatum*
11. Inflorescence paniculate or racemose with the racemes not clustered near the apex of the peduncle 14
14. Inflorescence with primary lateral branches strictly racemose or with slender uniform, raceme-like panicles (appearing 1-pinnate) 15
15. Plants generally greater than 100 cm tall. . . . . *Paspalum virgatum*
15. Plants less than 50 cm tall . . . . . *Paspalum nutans*
14. Inflorescence with branches compounded 2 or more times, diffuse, open, lacking distinctly racemose branches 16
16. Superior floret rugose or rugulose . . . . . *Panicum maximum*
16. Superior floret smooth 17
17. Inferior palea absent or shorter than the inferior lema . . . . . *Panicum polygonatum*
17. Inferior palea present and as long as or longer than the inferior lema . . . . . *Panicum laxum*

216. *Axonopus compressus* (Sw.) P. Beauv., Ess. Agrostogr. 12, 154, 167. 1812.

Distribution.— Common on Isla del Coco in the lawns and the cleared areas near the Wafer Bay ranger station. Distributed throughout the warm regions of the New and Old Worlds.

Remarks.— This species was published under the name *Paspalum platycaule* Poir. in Robinson (1902) and as *Digitaria sanguinalis* (L.) Scop. in Stewart (1912).

Specimens examined.— CR: *Gómez 3278*; FTG: *Trusty 260*; GH: *Howell 10177*; *Snodgrass and Heller 942*; US: *Howell 10177*; *Klawe 1509*; *Stewart 261*; *Svenson 305*.

217. **Cenchrus brownii* Roem. & Schott, Syst. Veg. 2:258. 1817.

Distribution.— Common on Isla del Coco in the lawns and the cleared areas near the Wafer Bay ranger station. Distributed from the southern United States through Central America to Bolivia and Brazil; also in the West Indies, Australia and the South Pacific.

Specimens examined.— CR: *Quesada 1042*; INB: *Quesada 1042*; *Rojas 3702*; USJ: *Soto s.n.*

218. ***Chloris paniculata*** Scribn., Proc. Amer. Acad. Arts 38(4):262. 1902.

Type: *Snodgrass and Heller 968* (holotype: GH).

Herb to 70 cm tall; perennial; arising from an upright stout underground stem bearing many rootles and shreds of leaf sheaths; sheaths glabrous; ligule lacking; blades very long and narrow up to 50 cm long and 5 mm wide, arching, glabrous except for the scabrous margins; inflorescence panicle-like, made up of at least 50 spikes racemosely arranged on the upper 10 to 12 cm of the culm; spikes about 5 cm long at lower part of inflorescence, becoming progressively shorter near the tip; glumes narrow to broadly lanceolate, glabrous except for the scabrous midnerve; first glume ca. 1.2 mm × 0.2 mm; second glume ca. 3 × 0.4 mm; fertile lemma ca 2.6 × 0.6 mm, broadly lanceolate, glabrous except for the prominently bearded callus and scabrous keel, apex more or less obtuse. awn 2.5–2.8 mm long; sterile floret one, ca 1.5 × 0.2 mm, glabrous, awn 1.5–1.8 mm.

Distribution.— Commonly found on the islets near Isla del Coco and infrequent on the rocky cliffs of the island. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Dressler 4464*; *Lépiz 382*; FTG: *Trusty 341*; *Trusty 342*; INB: *Lépiz 382*; *Quesada 1113*.

219. *Digitaria setigera* Roth ex Roem. & Schult. var. *setigera*, Syst. Veg. 2:474. 1817.

DISTRIBUTION.— Common on Isla del Coco in the lawns and the cleared areas near the Wafer Bay ranger station. Native to tropical Asia; introduced in other tropical regions.

SPECIMENS EXAMINED.— FTG: *Trusty 79*; *Trusty 410*; *Trusty 467*; *Trusty 526*; GH: *Pittier 16268*; INB: *Rojas 3703*.

220. *Eleusine indica* (L.) Gaertn., Fruct. & Sem. Pl. 1:8. 1788.

DISTRIBUTION.— Common on Isla del Coco in the lawns and the cleared areas near the Wafer Bay ranger station. Introduced from the Old World and now widely naturalized. Distributed from the southern half of the United States south to northern Argentina and Uruguay; also the West Indies, Galápagos Islands, and the Old World.

SPECIMENS EXAMINED.— FTG: *Trusty 78*; *Trusty 358*; GH: *Pittier 16266*; INB: *Rojas 3700*.

221. **Eragrostis ciliaris* (L.) R. Br. in Tuckey, Narr. Exped. Zaire 478. 1818.

DISTRIBUTION.— Common on Isla del Coco in the lawns and the cleared areas near the Wafer Bay ranger station. Native to the tropics and subtropics of the Old World; naturalized in the tropics and subtropics of the Americas.

SPECIMENS EXAMINED.— CR: *Rojas 3705*; FTG: *Trusty 77*; INB: *Quesada 1040*; *Rojas 3705*; USJ: *Soto s.n.*

222. **Ischaemum rugosum* Salisb., Icon. Stirp. Rar. 1:pl. I. 1791.

DISTRIBUTION.— Infrequent on Isla del Coco in the lawns and cleared areas near the Wafer Bay ranger station. Native to the Old World but introduced throughout the tropics.

SPECIMENS EXAMINED.— INB: *Quesada 1050*.

223. **Melinis minutiflora* P. Beauv., Ess. Agrostogr. 54, t. 11, f. 4. 1812.

DISTRIBUTION.— Unknown distribution on Isla del Coco. Native to Africa but widely cultivated and naturalized in the American tropics.

REMARKS.— This species was reported by Fosberg and Klawe (1966), but no specimens were located.

SPECIMENS EXAMINED.— No specimens located.

224. **Panicum laxum* Sw., Podr. 23. 1788.

DISTRIBUTION.— Found near Chatham Bay on Isla del Coco. Native to tropical America but introduced into tropical West Africa.

SPECIMENS EXAMINED.— CR: *Dressler 4463*; *Gómez 3280*; *Gómez 3291*; *Valerio s.n.*

225. **Panicum maximum* Jacq., Icon. Pl. Rar. 1:2, t. 13. 1781.

DISTRIBUTION.— Very common on Isla del Coco in the disturbed area along the trail between Chatham and Wafer Bays. Native to the Old World but introduced throughout the Neotropics.

REMARKS.— This species is considered an invasive exotic in many island ecosystems (Swarbrick 1997, Space et al. 2003).

SPECIMENS EXAMINED.— CR: *Quesada 1133*; FTG: *Trusty 115*; INB: *Quesada 1133*.

226. **Panicum polygonatum* Schrad. in Schult., Mant. 2:256. 1824.

DISTRIBUTION.— Common throughout the open areas and trail edges throughout Isla del Coco. Distributed from Mexico to Paraguay; also found in Trinidad and Jamaica.

SPECIMENS EXAMINED.— CR: *Gómez 18034*; *Jiménez s.n.*; *Murawski 308*; FTG: *Trusty 168*; *Trusty 202*; *Trusty 241*; *Trusty 310*; *Trusty 344*; INB: *Rojas 3711*; US: *Howell 10173*.

227. *Paspalum conjugatum* P.J. Bergius, Acta Helv. Phys.-Math. 7:129,pl. 8. 1762.

DISTRIBUTION.— Common on Isla del Coco in the lawns and the cleared areas near the Wafer Bay ranger station. Native to the New World but now widely naturalized in pantropical and subtropical areas worldwide.

SPECIMENS EXAMINED.— CR: *Gómez 18035*; *Gómez 18074*; *Jiménez 3132*; *Jiménez 3134*; *Valerio s.n.*; FTG: *Trusty 37*; *Trusty 282*; *Trusty 359*; *Trusty 360*; INB: *Rojas 3698*; US: *Klawe 1489*; USJ: *Soto s.n.*

228. *Paspalum decumbens* Sw., Prodr. 22. 1788.

DISTRIBUTION.— Common on Isla del Coco in the lawns and the cleared areas near the Wafer Bay ranger station. Distributed from southern Mexico to Brazil and Bolivia; also in the West Indies.

SPECIMENS EXAMINED.— FTG: *Trusty 106*; *Trusty 361*; US: *Pittier 16209*; USJ: *Gómez-Laurito 6948*.

229. **Paspalum nutans* Lam., Tabl. Encycl. 1:175. 1791.

DISTRIBUTION.— Found in the lawn area near the Wafer Bay ranger station and along the trail from Wafer Bay to Cerro Iglesias on Isla del Coco. Distributed from Mexico to Ecuador, the Guianas, Brazil and the Antilles; introduced into the island of Mauritius.

SPECIMENS EXAMINED.— CR: *Gómez 3311*; *Jiménez 3169*; INB: *Quesada 1031*; *Rojas 3698.1*; *Rojas 3699*; US: *Gómez 3311*; *Klawe 1536*.

230. **Paspalum virgatum* L., Syst. Nat. ed. 10:855. 1759.

DISTRIBUTION.— Infrequent along the trail from Chatham Bay to Wafer Bay on Isla del Coco. Distributed from Texas and Mexico to Paraguay and Argentina; also found in the West Indies.

SPECIMENS EXAMINED.— CR: *Quesada 1134*; FTG: *Trusty 525*; INB: *Quesada 1134*; *Rojas 3698*.

231. *Pharus latifolius* L., Syst. Nat. ed. 10:1269. 1759.

DISTRIBUTION.— Infrequent on Isla del Coco near the Genio River in Wafer Bay. Distributed from Mexico to Bolivia and Brazil, the Guianas and the West Indies.

SPECIMENS EXAMINED.— CR: *Rojas 3584*; FTG: *Trusty 94*; INB: *Quesada 1046*; *Rojas 3584*.

232. *Setaria parviflora* (Poir.) Kerguélen, Lejeunia, n.s. 120:161. 1987.

S. geniculata (Lam.) P. Beauv.

DISTRIBUTION.— Common on Isla del Coco in the lawn and cleared areas near the Wafer Bay ranger station. Distributed from the southern United States to Argentina; also found in the West Indies and introduced elsewhere.

SPECIMENS EXAMINED.— CR: *Jiménez 3130*; *Soto s.n.*; GH: *Howell 10176*; *Pittier 16267*; FTG: *Trusty 80*; *Trusty 357*; INB: *Quesada 1047*; *Rojas 3704*; US: *Howell 10176*; USJ: *Soto s.n.*

233. **Sporobolus indicus* (L.) R. Br., Prodr. 170. 1810.

Distribution.—Rare; collected in Chatham Bay on Isla del Coco. Distributed from the southeastern United States and Mexico to Argentina and Chile; also found in the West Indies.

SPECIMENS EXAMINED.— CR: *Jiménez 3133* (not seen).

Rhizophoraceae

234. *Cassipourea guianensis* Aubl., Pl. Guiane 1:529, t. 211. 1775.

C. elliptica (Sw.) Poir.

Distribution.— Infrequent on Isla del Coco along the coast near the mouth of the Genio River in Wafer Bay. Distributed from Mexico to Peru; also found in the Antilles.

Specimens examined.— CR: *Gómez 3266*; *Sánchez 27*; FTG: *Trusty 236*; INB: *Quesada 1130*; USJ: *Poveda 812*.

Rubiaceae

1. Herbs 2
    2. Stipules fimbriate with 3–15 lobes 3
        3. Fruits indehiscent 4
            4. Fruits schizocharps with three indehiscent mericarps; corolla lobes 6 . . . . . *Richardia scabra*
            4. Fruits with simple; corolla lobes 4 . . . . . *Diodia sarmentosa*
        3. Fruits with one or two dehiscent valves 5
            5. Fruits with 2 unequal valves, one dehiscent and the other indehiscent . . . . . *Spermacoce exilis*
            5. Fruits with 2 equal valves, both dehiscent 6
                6. Calyx lobes 4, subequal or equal . . . . . *Borreria ocymoides*
                6. Calyx lobes 2 or 4; when 4, unequal with one pair half the size of the other . . . . . *Borreria prostrata*
    2. Stipules not fimbriate, unlobed 7
        7. Creeping herb, leaves up to 3 cm long . . . . . *Oldenlandia corymbosa*
        7. Erect herb to subshrub, leaves 10–20 cm long . . . . . *Hoffmannia piratarum*
1. Shrubs or trees 8
    8. Leaves with glandular punctations . . . . . *Rustia occidentalis*
    8. Leaves without punctations 9
        9. Ovules and seeds, one per locule 10
            10. Fruits single seeded . . . . . *Guettarda crispiflora* subsp. *sabiceoides*
            10. Fruits with more than one seed 11
                11. Corolla with convolute lobes . . . . . *Coffea arabica*
                11. Corolla with valvate lobes 12
                12. Shrub to 1 m tall; leaves lacking domatia; fruits purple . . . . . *Psychotria gracilenta*
                12. Shrub or tree greater than 1 m tall; leaves with domatia at axils of secondary veins; fruits red . . . . . *Psychotria cocosensis*
        9. Ovules and seeds numerous per locule 13
            13. Inflorescences axillary . . . . . *Hoffmannia nesiota*
            13. Inflorescences terminal . . . . . *Bertiera angustifolia*

235. ***Bertiera angustifolia*** Benth., Bot. Voy. Sulphur 103. 1845. (Fig. 16)

Type: *Barclay s.n.* (holotype: BM!; Isotype: GH!)

Shrubs or trees to 5 m tall, the branchlets terete, smooth, densely pilose, the nodes well spaced. Leaves pellucid punctate, arising as juveniles from a cylindrical bract or pair of bracts, the bract drying brown, puberulent; stipules connate in the sheath, split from the side, the apex bidentate; leaf

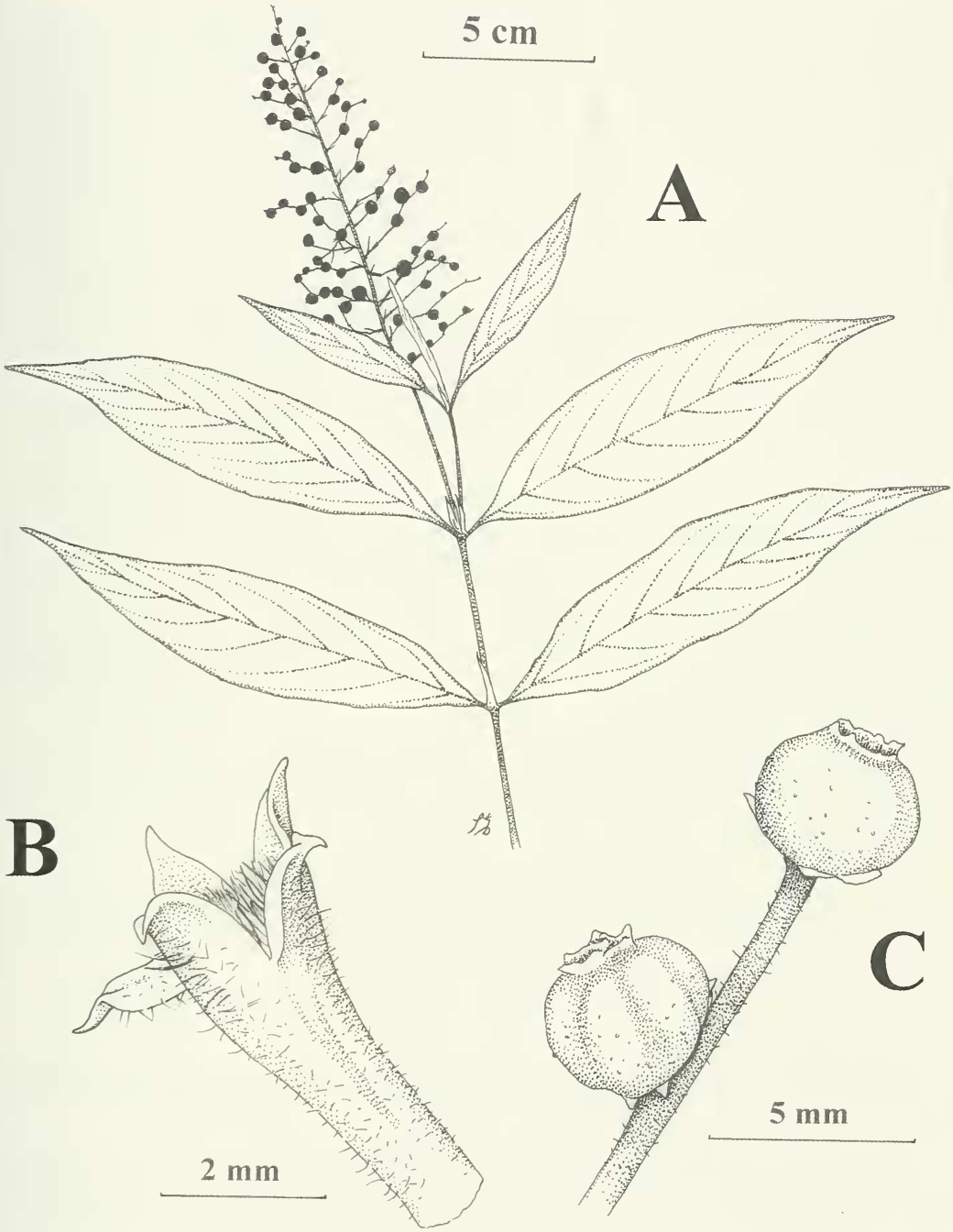

FIGURE 16. *Bertiera angustifolia* (drawn from *Trusty 217*). A. Branch of plant showing terminal inflorescence. B. Lateral view of flower. C. Close up of two fruits.

blades ovate oblong, 9–13 cm long, 1.6–3.2 cm wide, acute towards the apex, acuminate, the acumen conspicuous, cuneate or rounded at the base, the costa prominulous, the lateral veins 5–7 pairs, strongly ascending, sometimes immersed above, leaves papery when dry, rubescent above, glabrous except for the costa and margins, glabrous beneath except for the costa and veins, the hairs simple, appressed, elongate; petioles to 0.7 cm long, pubescent; stipules triangular subulate, puberulent, to 1.5 cm long, ca. 0.5 wide at the base, ultimately appressed to the stem. Inflorescences terminal, solitary, paniculate, puberulent, to 6–12 cm long, to 4 cm wide; peduncle slender, 2.5–4.0 cm long, the rachis somewhat flexuous, the branches alternate or opposite; bracts and bracteoles linear subulate, 6–16 mm long, pubescent; flowers sessile, the calycine cup small, the teeth 5, small, triangular; corolla white, 4.0–5.0 mm long, carnose, glabrous or sparsely puberulent outside, densely villose with orange hairs inside, the lobes deltoid, to 1.5 mm long, acute; stamens 5, the anthers oblong, to 1.5 mm long, short acuminate at the apex, the acumen ca. 0.4 mm long; stigma 5-sided, 2 mm long and 0.5 mm wide; fruits sessile, rotund, 3.0–3.5 mm in diameter, drying black, sparsely pubescent, the hairs short, strigose, the ribs obvious, marginate, the calycine cup vestigial.

Distribution.— Infrequent in the closed canopy forest between 250–450 msl. Endemic to Isla del Coco.

Remarks.— Dwyer (1980) reported this species from Panama but did not see the type specimen collected from Isla del Coco. He stated that although Bentham described the leaves of *B. angustifolia* as pellucid punctate, the Panamanian collections he examined are not. *Bertiera angustifolia* as determined from the type collection has much thinner (1.6–3.2 cm vs 2.7 to 7.5cm), pellucid-punctate leaves with prominent acumen, the secondary veins number 5–7 vs 8–9, and the inflorescences are shorter (up to 12 cm vs up to 17 cm) and thinner (4 cm vs 7 cm).

Specimens examined.— BM: *Barclay s.n.*; CR: *Barclay 2184*; FTG: *Trusty 116*; *Trusty 217*; GH: *Barclay s.n.*; *Foster 4135*; INB: *González 1220*; *Lépiz 346*; *Soto 3862*; *Quesada 1119*; NY: *Barclay 2184*; US: *Barclay 2184*.

236. *Borreria ocimoides* (Burm. f.) DC., Prodr. 4:544. 1830.

Distribution.— Infrequent on Isla del Coco in full sun in cleared areas and near river edges. Widespread from Mexico to Peru and Bolivia.

Specimens examined.— FTG: *Trusty 259*; *Trusty 553*.

237. **Borreria prostrata* (Aubl.) Miq., Stirp. Surinam Select. 177. 1851.

Distribution.— Frequent on Isla del Coco near the edge of the Genio River in Wafer Bay. Distributed from Mexico to Brazil and Bolivia; also found in the West Indies and Africa.

Remarks.— First report for Isla del Coco.

Specimens examined.— FTG: *Trusty 391*.

238. **Coffea arabica* L., Sp. Pl. 172. 1753.

Distribution.— Persisting from cultivation on Isla del Coco. Spreading from Chatham and Wafer Bay cleared areas into forest along the trail to Cerro Iglesias. Native to Ethiopia but widespread in cultivation throughout the world.

Remarks.— This species is one of the greatest potential threats to the native flora of Isla del Coco as it is the only introduced species that is shade tolerant. In addition, this species has been found to be an invasive exotic in many island ecosystems (Space et al. 2003; Pacific Island Ecosystems at Risk 2002), and we recommend its removal.

Specimens examined.— CR: *Lépiz 348*; *Quesada 1096*; *Rojas 3587*; FTG: *Trusty 147*; *Trusty 459*; INB: *González 1146*; *Lépiz 348*; *Quesada 1096*; *Rojas 3587*.

239. **Diodia sarmentosa* Sw., Prodr. 30. 1788.

Hemidiodia ocymifolia (Willd.) K. Schum.

DISTRIBUTION.— Infrequent on Isla del Coco in open areas along trails and river edges. Distributed from Mexico to eastern Brazil; also found in the Greater Antilles and Africa.

SPECIMENS EXAMINED.— CR: *Gómez 3288*; *Gómez 6960*; *González 1156*; *Lépiz 367*; *Quesada 1044*; *Rojas 3689*; FTG: *Trusty 93*; *Trusty 222*; INB: *González 1156*; *Lépiz 367*; *Quesada 1044*; *Rojas 3689*; US: *Klawe 1499*.

240. *Guettarda crispiflora* subsp. *sabiceoides* (Standl.) C.M.Taylor, Novon 11:133, f. 3E, F. 2001.

G. conferta Benth.

DISTRIBUTION.— Collected once in Chatham Bay on Isla del Coco. This species is found from southern Costa Rica to Bolivia.

REMARKS.— This species has not been collected since 1902.

SPECIMENS EXAMINED.— GH: *Pittier 16255*; US: *Barclay 2190*; *Pittier 16255*.

241. ***Hoffmannia nesiota*** Donn. Sm., Bot. Gaz. 61:374–375. 1916. (Fig. 17)

Type: *Pittier 12387* (holotype: US!).

Shrub to 2 m tall. Branchlets subterete, glabrous; leaves opposite, the petioles stout, almost three-sided, 7–8 cm long, 2–3 mm thick, pubescent; mature leaf blades broadly elliptic, 18–26 cm long, 10–13 cm wide, elliptic to broadly elliptic-oblong, acuminate, base obtuse and slightly decurrent, stiffly chartaceous and pubescent or glabrescent, secondary veins 12–16 per side; inflorescence cymose, with few or many flowers, lax, the peduncles mostly 1–5 cm long, pubescent or glabrescent, lacking bracts and bracteoles, the pedicels 6–10 mm long, slender; flowers 15–16 mm long, with pyramidal calyx tube, lobes narrowly triangular, 1.5–2 mm long, acute; corolla four-fid, 11 mm long, rotate, puberulent, the linear lobes acute, about equaling the tube; stamens four, attached to the throat of the corolla, anthers subsessile, linear 5.5 mm long, connective brown, elongated toward the apex; disk elevated, strongly convex; ovary at anthesis, oblong-obovoid, twice as long as wide, slightly four-sided, trilocular, style 12 mm long, stigma lobes subconnate, oblong-ovate, 1.5 mm long; fruit globose, bright red when ripe, 1 cm in diameter, toothed calyx not accrescent, crowning; seeds ellipsoid, 0.5 mm long, minutely pitted, reddish.

DISTRIBUTION.— Rare; found in Wafer and Iglesias Bays. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *L. Gonzalez 661*; FTG: *Trusty 96*; INB: *Quesada 1128*; US: *Barclay 2178*; *Pittier 12387*.

242. ***Hoffmannia piratarum*** Standl., J. Wash. Acad. Sci. 18:180. 1928.

Type: *Pittier 16259* (holotype: US).

Suffrutescent herb to 1 m tall; branches obtusely quadrangular, glabrous, the internodes 1.5–3 cm long; stipules caducous; leaves opposite, the petioles slender, 2.5–4.5 cm long, glabrate; leaf blades elliptic-lanceolate, 10–20 cm long, 5–6 cm wide, long-acuminate, the acumen narrow, long-attenuate, often falcate, the blades membranaceous, deep green above, glabrous, paler below, sparsely short-villous with ferruginous hairs beneath when young but soon glabrate; the costa prominent, rather stout, the secondary veins 8–9 on each side, very slender, strongly ascending, arcuate, irregularily anastomosing close to the margin; inflorescence axillary; inflorescence in leaf axils, cymes solitary or fasciculate, dense, 1–3-flowered, to 3 cm long, the peduncles 1–2.5 cm long, short villous, the bracts caducous; pedicels 2–5 mm long, usually short-villous; flowers puberulent proximally, hypanthium 3 cm long, calyx lobes 4, triangular-oblong, 2–3 mm long, acute or rounded, villous-ciliate; corolla white, glabrous, 1 cm long, glabrous or with a few short hairs at

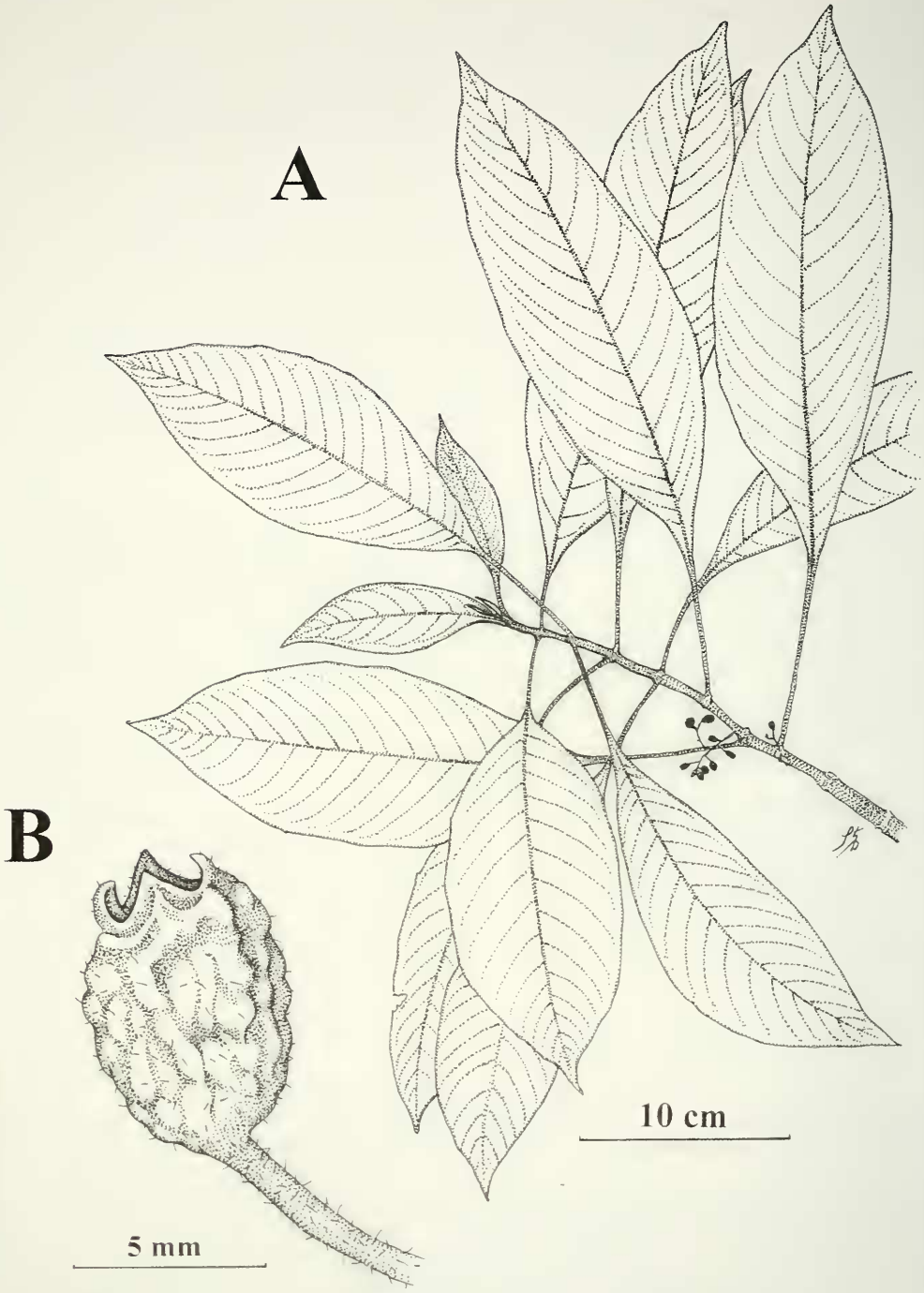

FIGURE 17. *Hoffmannia nesiota* (drawn from *Trusty 96*). A. Branch of plant showing axillary infructesence. B. Close up of dried fruit.

the apex, the tube obconic, 2 mm wide at the base, 5 mm wide at the throat, the lobes oblong-triangular, slightly shorter than the tube; ovary 2-locular; fruit subglobose, 6 mm long, glabrous; seeds minute, subglobose, dark brown, coarsely and deeply pitted.

DISTRIBUTION.— Along the edge and floodplain of the Genio River in Wafer Bay. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 271*.

243. *Oldenlandia corymbosa* L., Sp. Pl. 119. 1753.

DISTRIBUTION.— Common on Isla del Coco in cleared or disturbed areas in Wafer Bay. Native to Africa but widespread in the tropics of the world.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 92*; *Trusty 174*; *Trusty 254*; INB: *Quesada 1043*; *Rojas 3708*.

244. ***Psychotria cocosensis*** C. W. Ham., Phytologia 64:222. 1988. (Fig. 18)

TYPE: *Pittier 12375* (holotype: US).

Shrub; young stems glabrous, the bark furrowed longitudinally; stipules lanceolate, 12–35 × 2–5 mm, glabrous, caducous. Leaves petiolate; petioles 7–14 mm long, glabrous; blades membranous to coriaceous, elliptical, the apex acuminate to subcaudate, the base attenuate, (12) 14–17 × 5.5–7 cm, glabrous above and below, drying red-brown to green-brown; secondary veins (9) 10–12 pairs; diverging 45°–50°, eucamptodromous to brochidodromous, straight then arcuate mear margin, elevated below in less coriaceous leaves, the axils with small domatia below; tertiary veins inconspicuous to evident percurrent to reticulate. Inflorescences terminal, panicles of cymes; panicle branched 2–3 degrees; main axis 1 cm long, the peduncle lacking; secondary axes in 2 ranks, the first rank axes 2, 0.6 cm long, the second rank axes 2, reduced; cymes branched to 1 degree; bracts triangular, 0.7–1.5 mm long, glabrous. Flowers pedicellate, the pedicels 2–3 mm long; calyx cup-shaped, the tube 1 mm long, the lobes 5, broadly triangular to barely evident, glabrous; corolla white, the tube cylindrical, 3 × 3 mm, white pubescent in throat, the lobes 5, linear, 4 × 2 mm; stamens 5, the filaments 7 mm long, the anthers 2 mm long; style 9–10 mm long, the branches minute, linear. Fruit spherical to ellipsoidal, 6 mm long, 5.5–6 mm in diameter, red drying dark red-brown; persistent calyx cuplike, coriaceous, 1.5 mm long; seeds 2, the dorsal surface with 4 shallow irregular longitudinal furrows, the ventral surface with 2 deep irregular longitudinal furrows.

DISTRIBUTION.— Frequent in closed canopy forest from 150–630 msl. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Foster 4132*; *L. Gonzalez 637*; *Lépiz 333*; *Quesada 1080*; *Rojas 3623*; *Rojas 3684*; FTG: *Trusty 69*; *Trusty 188*; *Trusty 224*; *Trusty 265*; *Trusty 333*; *Trusty 396*; INB: *González 1167*; *Lépiz 333*; *Rojas 3623*; *Rojas 3684*.

245. *Psychotria gracilenta* Müll. Arg., Flora 59:545. 1876.

P. brachybotrya Müll.Arg.

DISTRIBUTION.— Common on Isla del Coco in the understory of the closed canopy forest from 250–550 msl. Distributed from Nicaragua to the Guianas and Peru.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 65*; *Trusty 543*; INB: *González 1171*; *Lépiz 344*; *Quesada 1032*; *Quesada 1045*; *Rojas 3640*.

246. **Richardia scabra* L., Sp. Pl. 330. 1753.

DISTRIBUTION.— Found in the lawn and disturbed areas near the Wafer Bay ranger station on

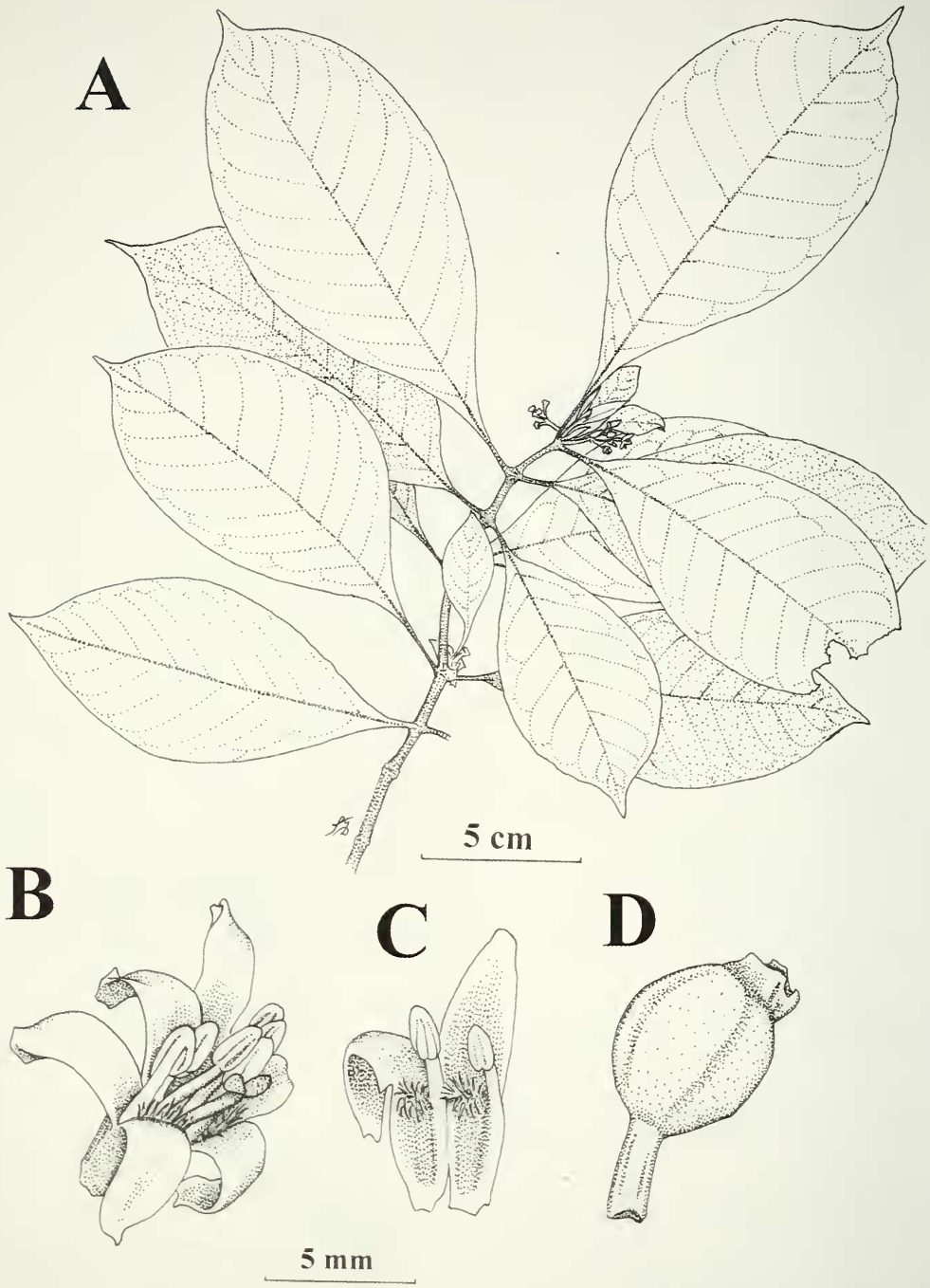

FIGURE 18. *Psychotria cocosensis* (drawn from *Trusty 265*). A. Branch of plant showing axillary inflorescence. B. Close up of flower. C. Longitudinal section of corolla showing pubescence. D. Lateral view of fruit.

Isla del Coco. Distributed from the southern United States to Brazil and the Antilles; also introduced to Africa and Asia.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— CR: *Quesada 1037*; *Rojas 3714*; *Soto s.n.*; FTG: *Trusty 75*; *Trusty 352*; INB: *Quesada 1037*; *Rojas 3714*; USJ: *Soto s.n.*

247. *Rustia occidentalis* (Benth.) Hemsl., Biol. Cent. Amer. Bot. 2:14. 1881.

DISTRIBUTION.— Locally common on Isla del Coco along the banks of the Genio River in Wafer Bay. Distributed from Nicaragua to Colombia.

REMARKS.— Mainland populations of this species are reported to have red/orange flowers while the Isla del Coco plants are a light lavender color.

SPECIMENS EXAMINED.— CR: *Gómez 3307*; *Jiménez 3173*; *Murawski 320*; *Poveda 814*; *Rojas 3653*; *Sánchez 14*; FTG: *Trusty 203*; *Trusty 352*; INB: *González 1177*; *González 1205*; *Rojas 3653*; USJ: *Poveda 814*.

248. **Spermacoce exilis* (L. O. Williams) C. D. Adams, Fieldiana Bot., n.s. 33:316, f. 5. 1993.

Borreria exilis L. O. Williams

B. gracilis L. O. Williams

DISTRIBUTION.— Infrequent in Chatham Bay along the trail from Wafer to Chatham Bay on Isla del Coco. Distributed throughout the Neotropics and the islands of the Pacific Ocean.

REMARKS.— Although the type was collected on Isla del Coco, we have designated this species as introduced due to its widespread mainland distribution, its restriction to disturbed habitats on the island and its late (1939) collection date.

SPECIMENS EXAMINED.— FTG: *Trusty 297*; *Trusty 552*; INB: *González 1151*; *Lépiz 372*.

RUTACEAE

1. Petioles broadly winged, 2–15 mm wide. . . . . *Citrus x aurantifolia*
1. Petioles narrowly winged, up to 2 mm wide . . . . . *Citrus x aurantium*

249. **Citrus x aurantifolia* (Christ.) Swingle (pro sp.), J. Wash. Acad. Sci. 3:456. 1913.

DISTRIBUTION.— Cultivated on Isla del Coco in Wafer Bay. Native to the Old World but cultivated in the tropics and subtropics worldwide.

SPECIMENS EXAMINED.— Not collected.

250. **Citrus x aurantium* L. (pro sp.), Sp. Pl. 782–783. 1753.

DISTRIBUTION.— Cultivated on Isla del Coco in Wafer Bay. Native to the Old World but cultivated in the tropics and subtropics worldwide.

SPECIMENS EXAMINED.— Not collected.

SCHLEGELIACEAE

251. *Schlegelia brachyantha* Griseb., Cat. Pl. Cub. 191. 1866.

DISTRIBUTION.— Extremely common throughout the forest area of Isla del Coco from 50–600 msl. Widespread in the Neotropics.

SPECIMENS EXAMINED.— FTG: *Trusty 178*; *Trusty 215*; *Trusty 280*; *Trusty 317*; *Trusty 329*; *Trusty 335*; *Trusty 371*; *Trusty 508*; *Trusty 518*; INB: *González 1162*; *Lépiz 332*; *Quesada 1073*; *Rojas 3674*.

Scrophulariaceae

252. **Capraria biflora* L., Sp. Pl. 628. 1753.

Distribution.— Infrequent on Isla del Coco in the disturbed areas near the buildings in Wafer Bay. Distributed throughout suptropical and tropical America, introduced into the Old World.

Specimens examined.— CR: *Gómez 3297*; *Gómez 3312*; FTG: *Trusty 351*.

Solanaceae

1. Corolla lobes not divided to near the base. . . . . *Capsicum annuum* var. *aviculare*
1. Corolla lobes divided nearly to the base. 2
   2. Leaves glabrous, spines absent. . . . . *Solanum americanum*
   2. Leaves densely hirsute, spines present . . . . . *Solanum quitoense*

253. **Capsicum annuum* L. var. *aviculare* (Dierb.) D'Arcy & Eshbaugh, Phytologia 25(6): 350. 1973.

Distribution.— Cultivated on Isla del Coco at the Chatham Bay ranger station. Native to tropical America.

Remarks.— First report for Isla del Coco.

Specimens examined.— FTG: *Trusty 531*.

254. *Solanum americanum* Mill., Gard. Dict. ed. 8, Solanum: n. 5. 1768.

Distribution.— Infrequent along the rocky beaches around Isla del Coco. Distributed widely throughout the tropics.

Remarks.— First report for Isla del Coco.

Specimens examined.— FTG: *Trusty 456*.

255. **Solanum quitoense* Lam., Tabl. Encycl. 2:16. 1794.

Distribution.— Cultivated on Isla del Coco at the Wafer Bay ranger station. Native to Ecuador and Colombia but cultivated throughout the American tropics.

Remarks.— First report for Isla del Coco.

Specimens examined.— FTG: *Trusty 95*.

Theaceae

256. *Freziera calophylla* Triana & Planch., Ann. Sci. Nat., Bot., ser. 4, 18:261. 1862.

Distribution.— Rare on Isla del Coco, found only above 350 msl on Cerro Iglesias. Distributed from Panama to Colombia and Ecuador.

Remarks.— First report for Isla del Coco.

Specimens examined.— FTG: *Trusty 56*; *Trusty 290*; INB: *González 1181*; *Lépiz 376*.

Ulmaceae

257. *Trema micrantha* (L.) Blume, Mus. Bot. 2:58. 1856.

Distribution.— Found near the rocky beachfront at the mouth of the Genio River in Wafer Bay on Isla del Coco. Widely distributed in the tropics and subtropics of the Western Hemisphere.

Specimens examined.— GH: *Pittier 16240*.

Urticaceae

1. Leaves alternate, urticating hairs present . . . . . *Laportea aestuans*
1. Leaves opposite, urticating hairs absent 2

2. Plants decumbent, creeping; leaves less than 1 cm long . . . . . *Pilea microphylla*
2. Plants erect; leaves greater than 3 cm long . . . . . *Pilea gomeziana*

258. *Laportea aestuans* (L.) Chew, Gard. Bull. Singapore 21:200. 1965.
Fleurya aestuans (L.) Gaudich. ex Miq.

DISTRIBUTION.— Frequent along the rocky coastline of Isla del Coco. Distributed throughout Central and South America; also found in the West Indies, Arabia, Africa, Madagascar, India to Java and the lesser Sunda Islands.

SPECIMENS EXAMINED.— CR: *Gómez 3268*; *Sánchez 13*; FTG: *Trusty 108*; *Trusty 455*; INB: *Quesada 1053*; *Rojas 3716*; USJ: *Soto s.n.*

259. ***Pilea gomeziana*** W. C. Burger, Phytologia 31:269. 1975. (Fig. 19)

TYPE: *Gómez 3304* (holotype: F; isotype: CR, US).

Herb, bisexual (unisexual in early stages) leafy stems erect and unbranched, 20–50 cm tall, leafy internodes (2) 7–50 mm long, 1–4 mm thick, puberulent with thin curved or crooked whitish hairs 0.3–1 mm long; stipules 4–8 mm long, broad and rounded at the apex, persisting with the leaves; leaves usually subequal and similar in form at each node, usually differing by about ¼ in size but occasionally with the smaller leaf ½ the size of the larger (at the same node), petioles 1–5 cm long, 0.4–2 mm thick, sparsely puberulent, usually sucate above; laminae 3–15 cm long, 2.5–7 cm wide, broadly ovate to elliptic-ovate or elliptic, usually broadest below the middle, short-acuminate at the apex, obtuse to truncate at the base, margins serrate with 2 to 4 prominent teeth per cm, lamina drying very thin chartaceous or membranaceous, upper surface with with evenly spaced slender and transparent hairs about 1 mm long, lower surface with smaller hairs along the veins, venation palmate with 3(5) primary veins, the 5–10 pairs of secondary veins ascending, very short linear cystoliths scattered or in groups above; male inflorescences usually in the uppermost leaf-axils, 1–2 cm long, usually of several small clusters of flowers on an unbranched rachis; male flowers subsessile, the buds about 1 mm in diameter with clavate subapical appendages 1 mm long, perianth usually with a few thin hairs; female inflorescence in lower leaf-axils or at the lower leafless nodes, 2–5 cm long, the primary rachis with 1–4 branches, flower clusters very small and distant along the rachis; female flowers pedicellate, less than 0.5 mm long; fruit about 0.6 mm long, oblong in outline with convex survaces, pale brown, margins outlined by a submarginal ridge or dark-punctate lines.

DISTRIBUTION.— Frequent in wet areas near secondary rivers or streams below 250 msl throughout the island. Endemic to Isla del Coco.

SPECIMENS EXAMINED.— CR: *Dressler 4469*; *Lépiz 379*; FTG: *Trusty 97*; *Trusty 279*; *Trusty 489*; INB: *González 1203*; *Lépiz 379*; NY: *Dressler 4469*; USJ: *Lépiz 379*.

260. **Pilea microphylla* (L.) Liebm., Kongel. Danske Vidensk. Selsk. Skr. Naturvidensk. Math. Afd., ser. 5, 2:296. 1851.

DISTRIBUTION.— Rare; found in Wafer Bay on Isla del Coco. Distributed from Florida throughout tropical America.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— USJ: *Gómez 3391*.

VERBENACEAE

1. Leaves elliptic or lanceolate, 1.5–5.5 cm long; flowers capitate . . . . . *Lippia alba*
1. Leaves ovate, 8–28 cm long; flowers paniculate . . . . . *Cornutia microcalycina* var. *anomala*

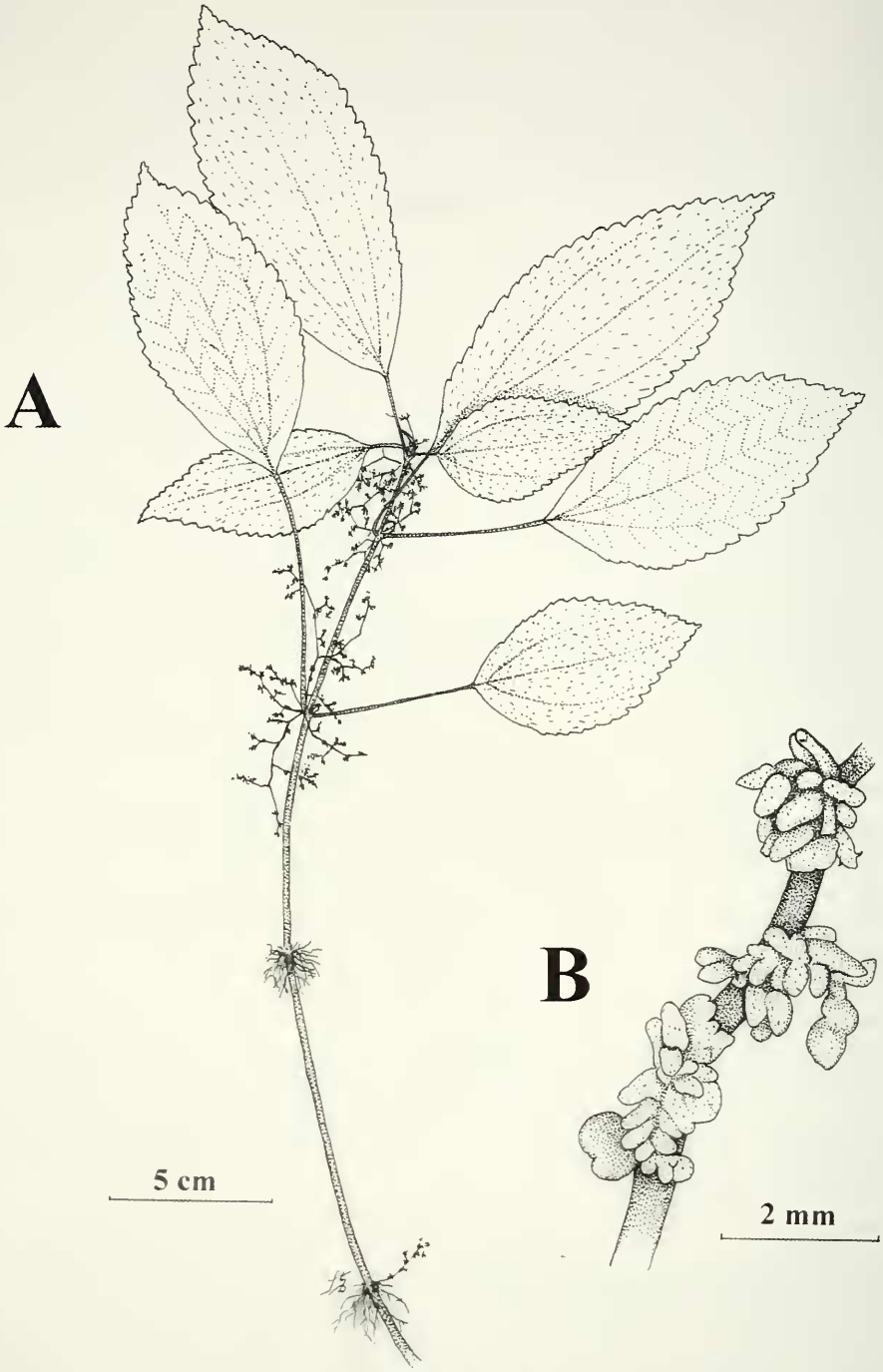

FIGURE 19. *Pilea gomeziana* (drawn from *Trusty 489*). A. Habit of plant showing axillary inflorescences. B. Close up of staminate inflorescence.

261. *Cornutia microcalycina* var. *anomala* Moldenke, Repert. Spec. Nov. Regni Veg. 40(1031/1039):176. 1936.

DISTRIBUTION.— Rare on Isla del Coco; found near the coast in Chatham Bay and also collected between Iglesias Bay and Cerro Tesoro Escondido. Distributed in Colombia, Ecuador and Venezuela.

REMARKS.— This species was published under the name *C. grandifolia* (Schltdl. & Cham.) Schauer in Stewart (1912) and Fosberg and Klawe (1966).

SPECIMENS EXAMINED.— GH: *Pittier 16254*.

262. **Lippia alba* (Mill.) N. E. Br. in Britton & P. Wilson, Bot. Porto Rico 6:141. 1925.

Distribution.—Locally common on Isla del Coco near the housing in Wafer Bay. Distributed from Texas and Mexico throughout the West Indies and Central and South America; introduced and cultivated elsewhere.

REMARKS.— This is probably a very recent introduction by humans to Isla del Coco due to its recent collection and the restricted distribution on the island near human settlements. First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 307*.

VISCACEAE

263. *Phoradendron piperoides* (Kunth) Trel., Phoradendron 145. 1916.

DISTRIBUTION.— Infrequent on Isla del Coco; parasite on *Ocotea insularis* and *Cecropia pittieri*. Distributed from Mexico to Argentina and the West Indies.

REMARKS.— First report for Isla del Coco.

SPECIMENS EXAMINED.— FTG: *Trusty 213*; *Trusty 214*; INB: *Quesada 1055*; *Rojas 3658*.

DOUBTFUL SPECIES

These species have been previously published for Isla del Coco but no specimens with the published names could be found. As there are related species that are common to the island, it is likely that these specimens have been incorrectly identified.

Ardisia humilis Vahl
Clidemia bullosa DC. (now a synonym of *C. condolleana* Cogn.)
Clidemia hirta (L.) D. Don
Ficus tecolutensis (Liebm.) Miq.
Hordeum secalinum Schreb.
Ipomoea batatas (L.) Poir. in Lam.
Nephrolepis pectinata (Willd.) Schott
Ossaea quinquenervia (Mill.) Cogn. (now a synonym of *C. quinquenervia* [Mill.] Almeda)
Paspalum vaginatum Sw.
Polystichum adiantiforme (Forst. f.) J. Sm.
Trichomanes pyxidiferum L.

ACKNOWLEDGMENTS

There are many people who have offered support and assistance to this work that we would like to thank. Dr. Javier Francisco-Ortega, graduate advisor for J. Trusty, has supported this floristic study since its inception and has been a scientific role model for her. In addition, this research

would never have been accomplished without the logistical and financial support of the Parque Nacional Isla del Coco administrators and park guards; we especially thank Fernando Quirós, Jorge Rodríguez, Freddy Salazar, Felipe Avilés and Guillermo Blanco. The crews of the *Okeanos Aggressor, Sea Hunter,* and *Undersea Hunter* provided transportation to the island. We thank Avi Klapfer for lending H. Kesler and J. Trusty a sea kayak for exploring the coast of the island. Claudine Sierra and Roco Gómez made the fieldwork more enjoyable and provided logistical support while we were on the island.

Dr. Brad Boyle and Dr. Robbin Moran not only supported the initiation of this project during the 2000 Organization for Tropical Studies (OTS) Plant Systematics class but also provided data, computer help and encouragement the whole way through. Dr. Barry Hammel and the staff at the Institute for Biodiversity in Costa Rica graciously provided us with a list of INBio's Cocos Island collections and allowed us to use their facilities for drying and identifying the specimens.

In addition, we are indebted to Lynka Woodbury, Jennifer Dropkin and Peter Doering and the Fairchild Tropical Botanic Garden herbarium volunteers for mounting, accessioning, filing, and requesting all of the Cocos Island specimens that made this flora possible. We thank Bruce Bartholomew and Mona Bourell (CAS), Armando Estrada (CR), Dr. Greg McKee and Rusty Russell (US), Victoria Noble (BM), Dr. Micheal Grayum (MO), and Emily Wood (GH) for their help with herbarium research and loans.

The taxonomy included in this work is the result of a number of dedicated systematists. Alexander Rojas provided descriptions and identifications of many pteridophyte species. Dr. Frank Almeda identified two new *Miconia* species. Dr. Piero Delprete identified a *Hoffmannia* collection. Dr. Eric Hágsater identified a number of Orchidaceae specimens. Mario Blanco was a key collaborator and provided photos of orchid collections from GH, the Universidad de Panamá (PMA), and the Universidad de Costa Rica (USJ). Dr. Susanne Renner provided the citation for Crossland's collection of *Schwackea cupheoides*. Dr. Jon Ricketson provided the species description of *Ardisia cuspidata.* Comments and revisions by Dr. Javier Francisco-Ortega, and Dr. Scott Zona and Dr. Brad Bennett improved the manuscript. Stig Dalström beautifully illustrated the 17 Isla del Coco endemic species for this publication. Finally, a special thanks to Dr. Frank Almeda and an anonymous reviewer whose comments greatly improved this manuscript.

This flora represents part of the doctoral dissertation of Jennifer Trusty submitted in partial fulfillment of the graduate requirements of Florida International University (FIU). This paper is contribution number 100 of the FIU Tropical Biology Program. The research was funded by a United States Environmental Protection Agency STAR Fellowship to J. Trusty, an Organization for Tropical Studies post-course grant to J. Trusty, and a Florida International University Tropical Biology grant to J. Trusty. Illustrations were funded by the FIU Graduate Student Association and Fairchild Tropical Botanic Garden. We greatly appreciate the generosity of the Cocos Island National Park Service in providing transportation to Isla del Coco and room and board during field research on the island for J. Trusty and H. Kesler. All plant material was collected following national and international permit regulations. CITES permits were obtained for the collection of tree fern and orchid taxa collected on Isla del Coco.

Literature Cited

Adams, C.D. 1992. Eleven new species, a new variety, and a new varietal combination in the fern genera *Asplenium* and *Diplazium* in Central America. *Novon* 2:290–298.

Agassiz, A. 1891–1892. General sketch of the expedition of the *Albatross* from February to May 1891. *Bulletin of the Museum of Comparative Zoology* 23(1):1–89.

ALFARO, A. 1898. Informe sobre la fauna de la isla. *Revista del Colegio Superior de Señoritas*, Year 2(4/5):12–15.

ANDERSON, D.E. 1974. Taxonomy of the genus *Chloris* (Gramineae). *Brigham Young University Science Bulletin* 19:1–133.

ANONYMOUS. 1920. *Malpelo, Cocos and Easter Islands*. Handbooks prepared under the direction of the Historical Section of the Foreign Office. No. 141. H.M. Stationary Office. London, UK. 30 pp.

ARDITTI, J., AND A.K.A. GHANI. 2000. Tansley Review No. 110. Numerical and physical properties of orchid seeds and their biological implications. *New Phytologist* 145:367–421.

BAEZA, C.M., T.F. STUESSY, AND C. MARTICORENA. 2002. Notes on the Poaceae of the Robinson Crusoe (Juan Fernández) Islands, Chile. *Brittonia* 54:154–163.

BARRIE, F.R. 2005. Thirty-five new species of *Eugenia* (Myrtaceae) from Mesoamerica. *Novon* 15:4–49.

BELCHER, E. 1843. *Narrative of a Voyage Round the World, Performed in Her Majesty's Ship* Sulphur *During the Years 1836–1842*. Vol. 1. Henry Colburn, London, UK. 387 pp.

BELLON, H., R. SÁENZ, AND J. TOURNON. 1984. K-Ar radiometric ages of lavas from Cocos Island (Eastern Pacific). *Marine Geology* 54:17–23.

BENTHAM, G. 1844–1846. *The Botany of the Voyage of H.M.S. Sulphur, Under Command of Captain Sir Edward Belcher, During the Years 1836–42*. Published under the authority of the Lords Commissioners of the Admiralty, London, UK. Vol. 12. 196 pp.

BRATTON, S.P. 1974. The effect of the European wild boar (*Sus scrofa*) on the high-elevation vernal flora in the Great Smokey Mountains National Park. *Bulletin of the Torrey Botanical Club* 101:198–206.

BRENES, G., AND C. GONZALEZ. 1995. Geología, hidrología, clima y suelos. In *Plan General de Manejo Isla del Coco. Anexo I. Sondeo Ecológico Rápido*. FUNDEVI-PROAMBI-ICT-SPN. 104 pp.

BRUMMITT, R.K., AND C.E. POWELL, EDS. 1992. *Authors of plant names*. Royal Botanic Gardens, Kew, England, UK. 358 pp.

BURGER, W. 1975. New species in the Urticaceae. *Phytologia* 31:269.

BURGER, W., AND M. HUFT. 1995. Flora Costaricensis, Family 113 — Euphorbiaceae. *Fieldiana Botany*, New Series, 36:1–169.

BURGER, W.C., AND N. ZAMORA. 1991. Flora Costaricensis, Family 101a — Humiriaceae. *Fieldiana Botany*, New Series. 28:25–30.

CARLQUIST, S. 1965. *Island Life*. The Natural History Press. Garden City, New York, New York, USA. 451 pp.

CARLQUIST, S. 1970. *Hawaii: a Natural History*. Natural History Press, Garden City, New York, New York, USA. 463 pp.

CARLQUIST, S. 1974. *Island Biology*. Columbia University Press, New York, New York, USA. 650 pp.

CASTILLO, P., R. BATISTA, D. VANCO, E. MALAVASSI, J. BARQUERO, AND E. FERNÁNDEZ. 1988. Anonymously young volcanoes on hot spot traces: I. Geology and petrology of Cocos Island. *Geological Society of America Bulletin* 100:1400–1414.

CHRIST, H. 1904. *Trichomanes cocos*. *Bulletin de l'Herbier Boissier* 4:943.

CHRIST, H. 1909. *Lycopodium Pittieri*. *Bulletin de la Société Botanique de Genève* 1:236.

CHUBB, L.J. 1933. Geology of Galápagos, Cocos and Easter islands. *Bulletin of the Bernice P. Bishop Museum* 110:1–67.

COOK, O. F. 1940. An endemic palm on Cocos Island near Panama mistaken for the coconut palm. *Science* (new ser.) 91:140–142.

COSTA RICA, GOVERNMENT OF. 1996. Cocos Island Marine and Terrestrial Conservation Area: Nomination for inclusion in the World Heritage List of natural properties. Manuscript. 21 pp.

CROAT, T. 1978. *Flora of Barro Colorado Island*. Stanford University Press, Stanford, California, USA. 943 pp.

CRONK, C.B., AND J.L. FULLER. 1995. *Plant Invaders*. Chapmann & Hall, London, UK. 241 pp.

CROIZAT, L. 1958. *Panbiogeography*. Vol. 1. Published by the author, Caracas, Venezuela. 1018 pp.

DE VLAMING, V.L., AND V.W. PROCTOR. 1968. Dispersal of aquatic organisms: Viability of seeds recovered from the droppings of captive killdeer and mallard ducks. *American Journal of Botany* 55:20–26.

DIONG, C.H. 1982. *Population biology and management of the feral pig (Sus scrofa) in Kipahulu Valley*, Maui. Ph.D. Dissertation. University of Hawaii, Honolulu, Hawaii, USA. 408 pp.

Dwyer, J.D. 1980. Part IX. Family 179. Rubiaceae. Pages 1–522 *in* R.W. Woodson, Jr. and R.W. Schery, eds., *Flora of Panama*. Annals of the Missouri Botanical Garden, vol. 67.

Fosberg, F.R., and W.L. Klawe. 1966. Preliminary list of plants from Cocos Island. Pages 187–189 *in* R.I. Bowman, ed., *The Galápagos: Proceedings of the Symposia of the Galápagos International Scientific Project*. University of California Press, Berkeley.

Fournier, L.A. 1966. Botany of Cocos Island, Costa Rica. Pages 183–186 *in* R.I. Bowman, ed., *The Galápagos: Proceedings of the Symposia of the Galápagos International Scientific Project*. University of California Press, Berkeley, California, USA.

Futuyma, D.J. 1998. *Evolutionary Biology*, 3rd ed. Sinauer Associates, Inc., Sunderland, Massachusetts, USA. 875 pp.

Given, D.R. 1993. Changing aspects of endemism and endangerment in pteridophyta. *Journal of Biogeography* 20:293–302.

Gómez, J.R. 2004. *Estudio denso-poblacional de los reodores introducidos y su impacto sobre la fauna nativa en la Isla del Coco*. Master's Thesis. Universidad Nacional de Costa Rica, Herédia, Costa Rica. [unpaginated]

Gómez, L.D. 1971. Two new tree ferns from Costa Rica. *American Fern Journal* 61: 166–170.

Gómez, L.D. 1975. Contibuciones a la pteridologia costarricense. VII. Pteridofitos de la Isla de Cocos. *Brenesia* 6:22–48.

Gómez, L.D. 1976. Contribuciones a la pteridologia costarricense. X. Nuevos pteridophytos de la Isla de Cocos. *Brenesia* 8:97–101.

Guppy, H.B. 1906. *Observations of a Naturalist in the Pacific Between 1896 and 1899. Vol. 2: Plant-Dispersal*. Macmillan, London, UK. 627 pp.

Haberle, S.G. 2003. Late quaternary vegetation dynamics and human impact on Alexander Selkirk Island, Chile. *Journal of Biogeography* 30:239–255.

Hágsater, E., L. Sánchez S., and J. García-Cruz, eds. 1999. *Icones Orchidacearum 3. The Genus* Epidendrum*: Part 2. A Second Century of New Species in* Epidedrum. Herbario AMO, Mexico, D.F., Mexico. 100 pls.

Hamilton, W.C. 1988. New species and combinations in Mesoamerican *Psychotria* subgenus *Psychotria* (Rubiaceae). *Phytologia* 64:219–237.

Haug, G.H., and T. Tiedemann. 1998. Effect of the formation of the Isthmus of Panama on Atlantic Ocean thermohaline circulation. *Nature* 393:673–676.

Herrera, W. 1986. *Clima de Costa Rica*, vol. 2. *In* L.D. Gómez, ed., Vegetación y Clima de Costa Rica. Editonal Universidad Estatal a Distanua (EUNED), San José, Costa Rica. 118 pp.

Hertlein, L.G. 1963. Contribution to the biogeography of Cocos Island, including a bibliography. *Proceedings of the California Academy of Sciences*, ser. 4, 32:123–235.

Holdridge, L. 1974. Determination of world plant formations from simple climatic data. *Science* 105:367–368.

Holmgren, P.K., N.H. Holmgren, and L.C. Bartlett. 1990. *Index herbariorum. Part 1: The Herbaria of the World*, 8th ed. *Regnum Vegetable* 120:1–693.

Jinesta, R. 1937. *La Isla del Coco*. Imprenta Falco Hermanos, San José. Costa Rica. 24 pp.

Judd, W.S., C.S. Campbell, E.A. Kellogg, P.F. Stevens, and M.J. Donoghue. 2002. *Plant Systematics, a Phylogenetic Approach*, 2nd ed. Sinauer Associates, Inc., Boston, Massachusetts. 576 pp.

Lavergne, C., J.-C. Rameau, and J. Figier. 1999. The invasive woody weed *Ligustrum robustum* subsp. *walkeri* threatens native forests on La Réunion. *Biological Invasions* 1:377–392.

León de la Luz, J.L., J.P. Rebman, and T. Oberbauer. 2003. On the urgency of conservation on Guadalupe Island, Mexico: is it a lost paradise? *Biodiversity and Conservation* 12:1073–1082.

Lievre, D. 1893. Una isla desierta en el Pacifico. La Isla del Coco (America). In *Los Viajes de Cockburn y Lievre por Costa Rica*. 1963. Editorial Costa Rica, San José, Costa Rica. 134 pp. [Spanish translation of 1735 English edition, by Carlos Meléndex.]

Lonsdale, W.M. 1999. Global patterns of plant invasions and the concept of invasibility. *Ecology* 80:1522–1536.

Madrigal, M. 1954. La Isla del Coco. *Centroamericana* 3:80–84.

MAXON, W.R. 1922. *Alsophila notabilis. Contributions from the United States National Herbarium* 24:39.

MAXON, W.R. 1913. *Lycopodium brachiatum. Contributions from the United States National Herbarium* 17:176.

MICKEL, J.T. 1992. New species of the fern genus *Elaphoglossum* from Mesoamerica. *Novon* 2:368–382.

MOLVRAY, M., AND J. P KORES. 1995. Character analysis of the seed coat in Spiranthoideae with special reference to the Diurideae (Orchidaceae). *American Journal of Botany* 82:1443–1453.

MONTOYA, J.M. 1990. *Plan de Majejo Parque Nacional Isla del Coco*. Sistema de Parques y Reservas Marinas (SIPAREMA), Servicio de Parque Nacionales (SPN), Ministerio de Recursos Naturales, Energia y Minas (MINEMEM). Documento de Trabajo ver. 14.

MORAN, R. 1993. Robinson Crusoe's ferns. *Fiddlehead Forum* 20:44–48.

MOULTON, M.P., AND S.L. PIMM. 1986. Species introductions to Hawaii. Pages 231–249 *in* H.A. Mooney and J.A. Drake, eds., *Ecology of Biological Invasions of North America and Hawaii*. Springer-Verlag, New York, New York, USA.

NYBG. 2004. *<http://www.nybg.org/bsci/french_guiana/disp_bio.html>*.

PACIFIC ISLAND ECOSYSTEMS AT RISK. 2002. *<http://hear.org/pier_v3.3.htm>*.

PASSMORE, R.M. 1895. Informe sobre la Isla del Coco. Pages 5–12 *in* A. Alvarado, ed., *Nuevos apuntes y bibliografia de la Isla del Coco*. Instituto Geográfico Nacional. San José, Costa Rica.

PAX, F., AND K. HOFFMAN. 1924. *Acalypha pittieri*. Page 18 *in* A. Engler, ed., *Das Pflanzenreich IV*. Wilhelm Engelmann, Leipzig, Germany.

PIMENTAL, D., L. LACH, R. ZUNIGA, AND D. MORRISON. 2000. Environmental and economic costs of nonindigenous species in the United States. *Bioscience* 50:53–65.

PITTIER, H.F. 1898. Apuntamientos preliminares sobre la Isla del Cocos, posesión costarricense en el Océano Pacifico. *Revista del Colegio Superior de Señoritas*, Year 2(4/5):2–11.

PROCTOR, V.W. 1968. Long-distance dispersal of seeds by retention in digestive tract of birds. *Science* 160:321–22.

QUAMMEN, D. 1996. *The Song of the Dodo: Island Biogeography in the Age of Extinction*. Scribner, New York, New York, USA. 704 pp.

RIDLEY, H.N. 1930. *The Dispersal of Plants Throughout the World*. L. Reeve, Ashford, England, UK. 744 pp.

ROBINSON, B.L. 1902. Flora of the Galápagos Islands. Contributions from the Gray Herbarium of Harvard University, new series, no. 24. *Proceedings of the American Academy of Arts and Sciences* 38:77–269.

ROJAS-ALVARADO, A.F. 1996. Aportes a la flora pteridophyta costarricense. II. Taxones nuevos. *Brenesia* 45–46:33–50.

ROJAS-ALVARADO, A.F. 2001. Seis especies nuevas y dos nuevos regisros de helechos (Pteridophyta) para Costa Rica. *Revista de Biologia Tropical* 49:435–452.

ROJAS-ALVARADO, A.F. 2003. New taxa, new records and redefined concepts in the *Elaphoglossum* sect. *Elaphoglossum* subsec. *Pachyglossa* (Lomariopsidaceae) from Mexico and Central America. *Revista de Biología Tropical* 51:1–32.

ROJAS-ALVARADO, A.F., AND J.L. TRUSTY. 2004. Diversidad pteridofítica de la Isla del Coco. *Brenesia* 62:1–14.

ROJAS. O. 1964. Informe general de observaciones realizadas en la Isla del Coco. Pages 21–26 *in* A. Alvarado, ed., *Nuevos apuntes y bibliografía de la Isla del Coco*. Instituto Geográfico de Costa Rica, San José, Costa Rica.

ROSE, J.N. 1892. List of plants from Cocos Island. *Contributions from the United States National Herbarium* 1:135.

ROSEN. D.E. 1976. A vicariance model of Caribbean biogeography. *Systematic Zoology* 24:431–464.

SCHLECTER, F.R.R. 1918. Aufzählung der Orchidaceen von Zentral-Amerika. *Beihefte zum botanischen Centralblatt*. 36:404.

SHERRY, T.W., AND T.K. WERNER. 1984. List of bird species new to Cocos Island, Cost Rica since the report of Paul Slud. Blue Scorpion Expedition, San José, Costa Rica. 1 p.

SIERRA, C. 1998 Efectos del cerdo feral (*Sus scrofa*) sobre la erosión en la Isla del Coco, Costa Rica. Tesis de Maestría en Manejo de Vida Silvestre, Universidad Nacional, Heredía, Costa Rica. 73 pp.

SIERRA, C. 2001a. El cerdo cimarrón (*Sus scrofa*, Suidae) en la Isla del Coco, Costa Rica: composicíon de su dieta, estado reproductivo y genética. *Revista de Biología Tropical* 49:1147–1157.

SIERRA, C. 2001b. El cerdo cimarrón (Sus scrofa, Suidae) en la Isla del Coco, Costa Rica: escarbaduras, alteraciones al suelo y erosión. *Revista de Biología Tropical* 49:1159–1170.

SINGER, F.J., W.T. SWANK, AND E.E.C. CLEBSCH. 1984. Effects of wild pig rooting in a deciduous forest. *Journal of Wildlife Management* 45:343–353.

SLUD, P. 1967. The birds of Cocos Island (Costa Rica). *Bulletin of the American Museum of Natural History* 134:262–295.

SMITH, A.R. 1972. Comparison of fern and flowering plant distributions with some evolutionary interpretations for ferns. *Biotropica* 4:4–9.

SMITH, A.R., AND D.B. LELLINGER. 1985. *Thelypteris cocos. Proceedings of the Biological Society of Washington* 98(4):918.

SMITH, J.D. 1914. Undescribed plants from Guatemala and other Central American Republics. *Botanical Gazette* 57:374–375.

SPACE, J.C., AND M. FALANRUW. 1999. *Observations on Invasive Plant Species in Micronesia.* USDA Forest Service, Honolulu, Hawaii, USA. 32 pp.

SPACE, J.C., B. WATERHOUSE, J.S. DENSLOW, AND D. NELSON. 2000. Invasive plant species on Rota, Commonwealth of the Northern Mariana Islands. USDA Forest Service Report. Pacific Southwest Resarch Station. *<http://www.hear.org/pier/reports/report.htm>*

SPACE, J.C., B.M. WATERHOUSE, J.E. MILES, J. ZTIOTECH, AND K. RENGULBAI. 2003. *Report to the Republic of Palau on Invasive Plant Species of Environmental Concern.* USDA Forest Service, Honolulu, Hawaii, USA. 174 pp.

STANDLEY, P. 1928. New Plants from Central America. *Journal of the Washington Academy of Sciences* 18:180.

STANDLEY, P. 1937. *Marcgravia waferi.* Page 698 in *Flora of Costa Rica.* Field Museum of Natural History, Chicago, Illinois, USA.

STAPLES, G.W., D. HERBST, AND C.T. IMADA. 2000. Survey of invasive or potentially invasive cultivated plants in Hawaii. *Bishop Museum Occasional Papers* 65:26.

STEWART, A. 1912. Expedition of the California Academy of Sciences to the Galápagos Islands. 1905–1906. V. Notes of the botany of Cocos Island. *Proceedings of the California Academy of Sciences*, ser. 4, 1:375–404.

STRI. 2004. *<http://striweb.si.edu/esp/meta_data/plant_species.htm>.*

SVENSON, H. K. 1935. Plants of the Astor Expedition, 1930 (Galápagos and Cocos Islands). *American Journal of Botany* 22:208–277.

SVENSON, H.K. 1938. Pteridophyta of the Galápagos and Cocos Islands. *Bulletin of the Torrey Botanical Club* 65:303–333.

SWARBRICK, J.T. 1997. *Weeds of the Pacific Islands.* Technical paper no. 209. South Pacific Commission, Noumae, New Caledonia. 124 pp.

SWEARINGEN, J. 2003. Survey of National Park Service (in progress). *<http://www.nps.gov/plants/alien/list/a.htm>.*

TEMPLETON, A.R. 1982. Genetic architectures of speciation. Pages 105–121 *in* C. Barigozzi, ed., *Mechanisms of Speciation.* Alan R. Liss, New York, New York, USA.

TRYON, R. 1970. Development and evolution of fern floras of oceanic islands. *Biotropica* 2:76–84.

TUCKER, G.C. 1984. A revision of the genus *Kyllinga* Rottb. (Cyperaceae) in Mexico and Central America. *Rhodora* 86:507–533.

VTOROV, I.P. 1993. Feral pig removal: effects of soil microarthropods in a Hawaiian rain forest. *Journal of Wildlife Management* 57:875–880.

WAGNER, W.L., D.R. HERBST, AND S.H. SOHMER. 1990. *Manual of the Flowering Plants of Hawaii*, Vol. 1 University of Hawaii Press and Bishop Museum Press, Honolulu, Hawaii, USA. 1853 pp.

WERNER, R., AND K. Hoernle. 2003. New volcanolgical and volatile data provide strong support for the continuous existence of Galápagos Islands over the past 17 million years. *International Journal of Earth Science* 92:904–911.

Appendix

Tables 1–5
and
List of Exsiccatae

TABLE 1. Botanical expeditions to Isla del Coco. Abbreviations of herbaria as in Holmgren et al. (1990).

Expedition	Country/Institution	Collectors	Date	Principle Herbarium
Voyage of *H. M. S. Sulphur*	England	G. Barclay	April 1838	BM/K
Hopkins-Stanford Expedition to the Galápagos Islands	USA/Stanford University	R. Snodgrass and E. Heller	July 1899	GH/US/DS
Expedition of the US Fishing Commission	USA/United States Fish Commision	A. Agassiz	February 1891	US
Unknown	Costa Rica	H. Pittier	June 1898 January 1902	US/CR
California Academy of Sciences Expedition to the Galápagos	USA/California Academy of Science	A. Stewart	September 4-11, 1905	CAS
Expedition to the South Pacific of the *S. Y. St. George*	England	C. Crossland	April 1924	BM
Unknown	USA	A. K. Fisher	June 11, 1929	US
Vincent Astor Expedition	USA	H. K. Svenson	April 17-19, 1930	BKL
Templeton-Crocker Expedition/CAS	USA	J. Howell	June 28, 1932	CAS
US Presidential Cruise	USA	W. Schmitt	August 2, 1935	US
Unknown	Costa Rica	J. Valerio	May 4-7, 1936; December 1939;March 1940	CR
Galápagos International Scientific Project	USA/California Academy of Sciences	W. Klawe	December 5, 1959 September 3, 1967	CR
	USA	L. Hodridge	February 22-24, 1963	US
	Unknown	L. Fournier	March 8-9, 1964	US/CR/DAV
	Costa Rica	A. Jiménez	April 11-13, 1965	CR
	Costa Rica	L. D. Gómez	March 1970; March 1974; February 1976; December 1981	US/CR
		C. Lellinger and E. De La Sota	March 26, 1971	CR
		L. Carrasquilla and R. Dressler	August 13-17, 1973	US/CR
		L. Poveda	March 1974	CR
		P. Sánchez	July 1980	CR
		D. Murawaski	September 1981	CR
	Costa Rica/Universidad de Costa Rica	R. Soto	June 6-8, 1989	UCR/CR
	Unknown	R. Foster	April 9-11, 1979	US
	Costa Rica/Universidad de Costa Rica	G. Dauphin	January26-February 4, 1994	UCR/CR
	Costa Rica/Instituto Nacional de Biodiversidad	F. Quesada	September 22, 1994	INB
	Costa Rica/Instituto Nacional de Biodiversidad	E. Lépiz	June 13-16, 1994	INB
	Costa Rica/ Instituto Nacional de Biodiversidad	J. González	August 14, 1996	INB
	Costa Rica/Instituto Nacional de Biodiversidad	A. Rojas	June 12-July 9, 1997	INB

TABLE 2. Vascular plant diversity on Isla del Coco.

	Families		Genera		Species	
	Native	Introduced	Native	Introduced	Native	Introduced
Ferns and Fern Allies	22	0	48	0	81	0
Dicotyledons	39	10	71	35	84	47
Monocoytledons	7	1	20	12	26	24
All vascular plants	68	11	139	47	191	71
Total	79		186		262	

TABLE 3. Biogeographical relationships of the endemic plant species of Isla del Coco based on morphological assessment.

Family	Genus	Species	Closest Relative(s)	Distribution of Closest Relative(s)	Citation
Euphorbiaceae	*Acalypha*	*pittieri*	Not listed		Pax and Hoffman 1923
Myrsinaceae	*Ardisia*	*cuspidata*	*A. pseudocuspidata*	Panama	J. Pipoly pers. comm.
Aspleniaceae	*Asplenium*	*barclayanum*	*A. cristatum*	south Florida, Mexico to Peru and Brazil, Galápagos Islands, Antilles, Trinidad and Tobago	Adams (1992)
			A. cladaleptan	southern Mexico to Peru	
			A. myriaphyllum	southern Mexico to Peru and Bolivia, Bermuda, and the Greater Antilles	
Aspleniaceae	*Asplenium*	*delicatulum* var. *cacosensis*	*A. delicatulum*	Mexico to Venezuela	Rojas and Trusty (2004)
Rubiaceae	*Bertiera*	*angustifalia*	*B. guianensis*	southern Mexico to Ecuador and Brazil	Bentham (1844-1846)
Cecropiaceae	*Cecropia*	*pittieri*	*C. peltata*	Mexico to Colombia and Venezuela	Stewart (1912)
			C. obtusa	French Guiana and Suriname to Bolivia	

TABLE 3 (continued)

Family	Genus	Species	Closest Relative(s)	Distribution of Closest Relative(s)	Citation
Lomariopsidaceae	*Elaphoglossum*	*cocosense*	*E. paleaceum*	Mexico to Peru and Brazil, Antilles, Azores Islands and Madeira	Mickel (1992)
Lomariopsidaceae	*Elaphoglossum*	*incognitum*	*E. latifolium*	Mexico to Peru and Brazil, and Antilles	Rojas-Alvarado (2003)
Lomariopsidaceae	*Elaphoglossum*	*reptans*	*E. lingua*	Costa Rica to Chile and Paraguay, and Antilles	Rojas-Alvarado (2003)
Orchidaceae	*Epidendrum*	*cocoense*	*E. santaclarense*	El Salvador to Panama	Hágsater et al. (1999)
			E. rafael-lucasii	Costa Rica	
			E. acunae	Mexico to Costa Rica, Cuba	
Orchidaceae	*Epidendrum*	*insulanum*	*E. repens*	Guatemala and Honduras to Ecuador	Schlecter (1918)
Orchidaceae	*Epidendrum*	*jimenezii*	*E. insulanum*	Cocos Island	Hágsater et al. (1999)
Myrtaceae	*Eugenia*	*cocosensis*	*E. pacifica*	Cocos Island	Barrie (2005)
Myrtaceae	*Eugenia*	*pacifica*	*E. coffeifolia*	Venezuela and Suriname to Peru and Brazil	Bentham (1844-1846)
Rubiaceae	*Hoffmannia*	*nesiota*	*H. pittieri*	Costa Rica to Colombia	Smith (1914)
Rubiaceae	*Hoffmannia*	*piratarum*	*H. nicotianifolia (syn. H. angustifolia)*	Mexico to Colombia	Standley (1928)
			H. psychotriifolia	Mexico to Panama	
Lycopodiaceae	*Huperzia*	*brachiata*	*L. portoricense*	Puerto Rico	Maxon (1913)
			L. wilsonii	southern Mexico to Ecuador, Antilles and Puerto Rico	Gómez (1976b)
Lycopodiaceae	*Huperzia*	*pittieri*	*H. linifolium*	southern Mexico to Peru and Bolivia, Antilles	Christ (1909)
Hymenophyllaceae	*Hymenophyllum*	*cocosense*	*H. hirsutum*	Mexico to Peru and Brazil, Antilles, and Trinidad	Rojas-Alvarado (1996)

TABLE 3 (continued).

Family	Genus	Species	Closest Relative(s)	Distribution of Closest Relative(s)	Citation
Dennstaedtiaceae	*Hypolepis*	*lellingeri*	*H. aspidiodes*	China and Vietnam	Rojas-Alvarado (2001)
Marcgraviaceae	*Marcgravia*	*waferi*	Not listed		Standley 1937
Melastomataceae	*Miconia*	*acanthotheca*	*M. theizens*	Costa Rica to Colombia and Brazil	F. Almeda pers. comm.
			M. brevitheca	Costa Rica, Panama and Ecuador	
Melastomataceae	*Miconia*	*sp. nov.*	Not available		
Urticaceae	*Pilea*	*gomeziana*	*P. pittieri*	Costa Rica to Colombia;	Burger (1975)
			P .pubescens	Mexico to Peru, and Brazil	
Rubiaceae	*Psychotria*	*cocosensis*	*P. panamensis*	Mexico to Panama, Colombia	Hamilton (1988)
Dennstaedtiaceae	*Saccoloma*	*elegans var. spinosa*	*S. elegans*	Mexico to Peru, and north-eastern Brazil, Dominican Republic, Greater Antilles, and Trinidad	Rojas and Trusty (in press)
Humiriaceae	*Sacoglottis*	*holdridgei*	*S. ovicarpa*	Panama to Colombia	Burger and Zamora (1991)
			S. amazonica	Colombia to Peru	
Grammitidaceae	*Terpsichore*	*cocosensis*	*T. cultrata*	southern Mexico to Peru and Brazil, Antilles, and Africa	Rojas-Alvarado (1996)
			T. mollissima	southern Mexico to the Guianas and Ecuador, Antilles	
Thelypteridaceae	*Thelypteris*	*calypso*	*T. eggersii*	Costa Rica to Venezuela and Peru	Gómez (1976b)
Thelypteridaceae	*Thelypteris*	*cocos*	*T. nockiana*	Jamaica	Smith and Lellinger (1985)
Hymenophyllaceae	*Trichomanes*	*capillaceum var. cocos*	*T. capillaceum*	Mexico to Venezuela and Peru, Greater Antilles	Christ 1904
Hymenophyllaceae	*Trichomanes*	*collariatum var. alvaradoi*	*T. collariatum*	Mexico to Peru and northern Brazil	Rojas-Alvarado (in review)

TABLE 4. Geographic relationships of the flora of Isla del Coco. Percentages are based on the 154 identified native species and the 30 endemics for which the closest relatives have been suggested. Data for individual species can be found in the List of Vascular Plants.

	Caribbean		*Central America*		*Northern South America*		*Not in Central America or northern South America*	*Old World*	
	Present	Restricted	Present	Restricted	Present	Restricted		Present	Restricted
Native (154 spp.)	110 71.4%	0 0	150 97.4%	3 1.9%	143 92.9%	4 2.6%	0 0	46 29.9%	0 0
Closest relatives of endemics (30 spp.)	13 43.3%	1 3.3%	26 86.6%	3 10.0%	23 77.0%	1 3.3%	2 6.7%	3 10.0%	1 3.3%
Total (184 spp.)	123 66.8%	1 0.5%	176 95.7%	6 3.3%	166 90.2%	5 2.7%	2 1.1%	49 26.6%	1 0.5%

TABLE 5. Dispersal modes utilized by endemic native plants on Isla del Coco.

	Air	*Drift*	*Bird Internal*	*Bird External*
Endemic species (37 spp.)	21 56.8%	1 2.7%	12 32.4%	3 8.1%
Native Species (154 spp.)	69 44.8%	21 13.6%	39 25.3%	25 16.2%
Total (191 spp.)	90 47.1%	22 11.5%	51 26.7%	28 14.7%

List of Exsiccatae

The numbers in parentheses correspond with the species numbers in the present treatment.

Agassiz, A., s.n. (45); s.n. (49); s.n. (57); s.n. (207)

Barclay, G., 2178 (241); 2179 (98); 2182 (203); 2184 (235); 2184 (235); 2189 (125); 2190 (240); 2201 (10); 2206 (33); 2207 (9); 2208 (7); 2211 (46); s.n. (8); s.n. (10); s.n. (192); s.n. (235)

Carrasquilla, L., 360 (69); 362 (110)

Castaing, A., s.n. (125); s.n. (135); s.n. (167)

Crossland, C., 454 (193)

Dauphin, G., 1052 (170); 1053 (85); 1088 (46); 1091 (167); 1118 (8); 1128 (179); 1129 (14); 1130 (93); 1132 (101); 1138 (36); 1160 (188); 1163 (135); 1164 (214); 1165 (192); 1166 (34); 1168 (125); 1174 (186); 1175 (210); 1180 (59); 1181 (170)

Dressler, R. L., 4457 (46); 4458 (167); 4459 (115); 4460 (110); 4462 (31); 4463 (224); 4464 (218); 4465 (93); 4467 (167); 4468 (208); 4469 (259); 4471 (206); 4472 (192); 4473 (135)

Fisher, A. K., s.n. (7); s.n. (74)

Foster, R. B., 4114 (170); 4115 (90); 4117 (207); 4118 (80); 4122 (186); 4124 (188); 4126 (167); 4127 (179); 4128 (192); 4132 (244); 4135 (235); 4146 (144); 4152 (49); 4154 (52); 4156 (90); 4158 (75); 4161 (34); 4165 (31); 4168 (191); 4172 (106)

Fournier, L. A., 303 (182); 304 (184); 311 (110); 331 (8); 332 (26); 340 (192); 353 (186)

Fricke, R. L., s.n. (32)

Gómez, L. D., 3214A (31); 3261 (179); 3262 (189); 3263 (125); 3264 (181); 3265 (100); 3266 (234); 3268 (258); 3270 (206); 3271 (214); 3272 (106); 3274 (173); 3275 (112); 3277 (139); 3278 (216); 3280 (224); 3281 (132); 3286 (93); 3287 (101); 3288 (239); 3291 (224); 3293 (168); 3295 (89); 3296 (166); 3297 (252); 3298 (167); 3299 (176); 3302 (192); 3303 (176); 3306 (182); 3307 (247); 3311 (229); 3312 (252); 3313 (135); 3314A (31); 3317 (7); 3318A (32); 3319 (33); 3327 (40); 3328 (33); 3329 (28); 3330 (8); 3331 (79); 3332 (36); 3333 (1); 3334 (1); 3336 (70); 3337 (2); 3340 (23); 3341 (58); 3342 (80); 3343 (34); 3345A (32); 3346 (52); 3349 (6); 3350 (76); 3351 (14); 3352 (49); 3355 (56); 3356 (67); 3357 (9); 3358 (69); 3359 (72); 3360 (67); 3361 (76); 3362 (40); 3363 (57); 3364 (58); 3382 (138); 3383 (204); 3384 (134); 3386 (129); 3391 (260); 4502 (40); 4504 (6); 4507 (7); 4508 (41); 4513 (75); 4514 (10); 4516 (67); 4517 (6); 4519 (7); 4523 (18); 4527 (33); 4527A (33); 4529 (70); 4533 (76); 4534 (73); 4535 (15); 4536 (2); 4537 (15); 4538 (76); 4539 (76); 4540 (32); 4541A (36); 4541B (16); 4543 (32); 4545 (29); 4546 (36); 4547 (32); 4548 (34); 4553 (28); 6557 (32); 6558 (45); 6560 (45); 6561 (2); 6564 (46); 6565 (29); 6566 (35); 6567 (38); 6568 (35); 6931 (46); 6945 (46); 6960 (239); 18034 (226); 18035 (227); 18038 (33); 18040 (183); 18041 (170); 18042 (39); 18043 (210); 18044 (58); 18045 (6); 18047 (46); 18048 (181); 18051 (188); 18053 (77); 18054 (171); 18055 (167); 18057 (181); 18058 (28); 18060 (34); 18062 (29); 18063 (27); 18067 (28); 18068 (27); 18069 (31); 18070 (28); 18071 (34); 18072 (72); 18073 (33); 18074 (227); 18080 (34); 18089 (74); 18090 (10); 18092 (75); 18093 (32); 18094 (29); 18096 (76); 18097 (76); 18098 (35); s.n. (74); s.n. (100); s.n. (148)

Gómez-Laurito, J., 6904 (100); 6905 (198); 6913 (85); 6914 (206); 6915 (133); 6919 (181); 6920 (125); 6921 (135); 6923 (182); 6924 (207); 6925 (183); 6926 (183); 6927 (127); 6928 (144); 6930 (126); 6933 (182); 6934 (167); 6936 (135); 6938 (170); 6939 (179); 6940 (115); 6943 (110); 6946 (170); 6947 (179); 6948 (228); 6952 (156); 6953 (176); 6957 (125); 6966 (167); s.n. (66); s.n. (125)

González, J., 1141 (192); 1142 (100); 1143 (135); 1144 (171); 1145 (49); 1146 (238); 1148 (54); 1149 (167); 1150 (69); 1151 (248); 1153 (156); 1154 (181); 1155 (170); 1156 (239); 1159 (165); 1160 (183); 1162 (251); 1163 (8); 1164 (6); 1166 (182); 1167 (244); 1168 (85); 1169 (6); 1170 (186); 1171 (245); 1172 (13); 1173 (96); 1176 (47); 1177 (247); 1179 (191); 1181 (256); 1182 (192); 1185 (188); 1187 (90); 1188 (15); 1189 (75); 1190 (9); 1191 (176); 1192 (49); 1193 (54); 1194 (212); 1195 (60); 1196 (39); 1198 (33); 1199 (74); 1200 (182); 1201 (77); 1202 (61); 1203 (259); 1204 (184); 1205 (247); 1206 (178); 1208 (6); 1209 (39); 1213 (110); 1215 (215); 1216 (62); 1217 (69); 1218 (78); 1219 (109); 1220 (235); 1221 (10)

González, L., 637 (244); 649 (145); 660 (213); 661 (241)

González, J. and Sierra, C., 639 (179); 674 (178)

Hinds, R. B., s.n. (98)

Holdridge, L., 5132 (52); 5135 (31); 5136 (26); 5137 (28); 5138 (23); 5139 (27); 5143 (30); 5144 (46); 5146 (11); 5149 (75);5152 (18); 5154 (46); 5156 (69); 5157 (56); 5165 (93); 5166 (181); 5171 (192); 5179 (188); s.n. (186)

Holst, I. and Soto, R., s.n. (137)

Howell, J. T., 10167 (100); 10172 (142); 10173 (226); 10176 (232); 10177 (216); 10179 (46); 10183 (182); 10184B (204); 10185 (170); 10188 (125); 10189 (23)

Jiménez, A., 3130 (232); 3132 (227); 3133 (233); 3134 (227); 3140 (181); 3141 (182); 3143 (7); 3144 (135); 3146 (8); 3147 (52); 3148 (182); 3149 (181); 3151 (100); 3152 (184); 3157 (14); 3158 (11); 3161 (192); 3162 (34); 3164 (31); 3169 (229); 3173 (247); 3175 (63); 3176 (125); 3178 (208); 3179 (167); 3183 (170); 3184 (110); 3190 (179); 3197 (182); 3201 (78); 3204 (137); 3208 (32); 3209 (16); s.n. (34); s.n. (85); s.n. (117); s.n. (156); s.n. (179); s.n. (183); s.n. (226)

Klawe, W., 1479 (80); 1489 (227); 1495 (139); 1498 (49); 1499 (239); 1501 (137); 1503 (128); 1506 (72); 1509 (216);

1517 (106); 1536 (229); 1540 (9); 1542 (63); 1550 (192); 1555 (49); 1559 (149); 1560 (151); s.n. (8); s.n. (11); s.n. (23); s.n. (28); s.n. (29); s.n. (30); s.n. (31); s.n. (32); s.n. (33); s.n. (34); s.n. (46); s.n. (75); s.n. (76); s.n. (80); s.n. (207)

Lellinger, D. B., and de la Sota, E. R., 773 (23)

Lépiz, E., 328 (167); 329 (188); 330 (179); 330 (179); 331 (33); 332 (251); 333 (244); 334 (47); 335 (200); 336 (81); 337 (26); 338 (34); 339 (206); 341 (14); 342 (56); 343 (41); 344 (245); 345 (202); 346 (235); 348 (238); 349 (200); 350 (106); 350 (106); 351 (39); 352 (93); 353 (58); 354 (100); 355 (11); 356 (182); 357 (192); 359 (208); 360 (181); 361 (176); 362 (214); 363 (154); 364 (106); 365 (85); 366 (101); 367 (239); 368 (155); 369 (156); 370 (155); 371 (61); 372 (248); 373 (183); 374 (170); 375 (158); 376 (256); 378 (200); 379 (259); 380 (93); 381 (115); 382 (218)

Murawski, D. A., 301 (214); 306 (135); 307 (125); 308 (226); 320 (247); 325 (214); 327 (135); 332 (179); 347 (179); 348 (167); 365 (131)

Pittier, H., 12353 (26); 12355 (8); 12357 (46); 12358 (9); 12361 (49); 12370 (93); 12372 (182); 12373 (180); 12374 (186); 12376 (125); 12380 (135); 12381 (192); 12387 (241); 12390 (31); 12391 (181); 16209 (228); 16221 (182); 16223 (188); 16224 (192); 16225 (186); 16228 (8); 16229 (7); 16235 (2); 16236 (56); 16240 (257); 16243 (174); 16244 (93); 16246 (143); 16247 (203); 16249 (102); 16254 (261); 16255 (240); 16256 (166); 16262 (100); 16266 (220); 16267 (232); 16268 (219); 16271 (128); 16272 (137); 16273 (135); 16274 (125); 16277 (120); 16281 (149); 16350 (207)

Poveda, L. J., 810 (110); 812 (234); 813 (167); 814 (247); 817 (96); 821 (170); s.n. (179)

Quesada, F., 1001 (41); 1002 (42); 1003 (52); 1004 (56); 1005 (135); 1006 (192); 1007 (81); 1008 (14); 1009 (44); 1010 (33); 1012 (179); 1013 (167); 1013 (167); 1014 (34); 1015 (27); 1016 (6); 1017 (11); 1018 (125); 1020 (170); 1021 (85); 1024 (59); 1025 (160); 1026 (117); 1027 (114); 1028 (214); 1029 (80); 1030 (23); 1031 (229); 1032 (245); 1033 (182); 1035 (149); 1036 (102); 1037 (246); 1038 (145); 1039 (212); 1040 (221); 1041 (144); 1042 (217); 1043 (243); 1044 (239); 1045 (245); 1046 (231); 1047 (232); 1048 (182); 1049 (181); 1050 (222); 1051 (115); 1052 (116); 1053 (258); 1054 (154); 1055 (263); 1056 (122); 1057 (205); 1059 (168); 1060 (2); 1062 (213); 1063 (119); 1064 (110); 1064 (110); 1065 (101); 1067 (137); 1068 (139); 1069 (197); 1071 (202); 1073 (251); 1074 (47); 1075 (92); 1076 (139); 1077 (111); 1078.1 (25); 1080 (244); 1081 (210); 1082 (13); 1083 (89); 1084 (91); 1085 (10); 1086 (181); 1087 (39); 1089 (6); 1091 (106); 1093 (49); 1094 (49); 1094 (49); 1096 (238); 1097 (63); 1098 (100); 1100 (156); 1101 (155); 1102 (7); 1102 (7); 1103 (123); 1104 (61); 1105 (83); 1106 (153); 1107 (158); 1108 (188); 1109 (117); 1110 (176); 1112 (49); 1113 (218); 1114 (180); 1116 (32); 1118 (191); 1119 (235); 1122 (178); 1123 (37); 1125 (39); 1126 (92); 1127 (82); 1128 (241); 1130 (234); 1131 (121); 1132 (159); 1133 (225); 1134 (230); 1135 (164)

Rojas, A., 3575 (192); 3576 (182); 3577 (75); 3578 (16); 3579 (52); 3580 (40); 3581 (16); 3582 (61); 3583 (76); 3584 (231); 3585 (14); 3586 (66); 3587 (238); 3588 (65); 3589 (34); 3590 (8); 3591 (15); 3592 (77); 3593 (74); 3594 (63); 3595 (56); 3596 (59); 3597 (54); 3599 (49); 3600 (23); 3601 (27); 3602 (22); 3603 (25); 3604 (24); 3605 (20); 3607 (51); 3608 (41); 3609 (42); 3610 (33); 3611 (38); 3612 (13); 3614 (58); 3615 (28); 3616 (26); 3617 (10); 3618 (46); 3619 (4); 3620 (39); 3622 (18); 3623 (244); 3624 (188); 3625 (111); 3626 (47); 3627 (17); 3628 (21); 3630 (91); 3631 (167); 3632 (93); 3633 (186); 3634 (81); 3635 (6); 3636 (31); 3637 (98); 3638 (214); 3639 (100); 3640 (245); 3642 (40); 3643 (80); 3644 (48); 3645 (64); 3646 (67); 3647 (69); 3648 (62); 3649 (68); 3650 (9); 3651 (32); 3652 (60); 3653 (247); 3654 (167); 3655 (183); 3656 (106); 3657 (194); 3658 (263); 3659 (210); 3660 (207); 3661 (179); 3662 (34); 3663 (35); 3664 (30); 3665 (57); 3666 (114); 3669 (16); 3670 (200); 3671 (170); 3672 (110); 3674 (251); 3675 (213); 3676 (170); 3678 (101); 3679 (29); 3680 (7); 3681 (74); 3682 (170); 3683 (85); 3684 (244); 3685 (12); 3686 (78); 3687 (50); 3688 (215); 3689 (239); 3690 (158); 3691 (206); 3692 (209); 3693 (201); 3694 (191); 3696 (90); 3697 (117); 3698 (230); 3698.1 (229); 3699 (229); 3700 (220); 3702 (217); 3703 (219); 3704 (232); 3705 (221); 3708 (243); 3710 (87); 3711 (226); 3713 (176); 3714 (246); 3715 (145); 3716 (258); 3718 (22); 3719 (29); 3720 (45); 3773 (37); 3774 (8); 3775 (36); 3776 (5); 3777 (2); 3779 (180); 3780 (57); 3782 (70); s.n. (182)

Sánchez, P., 1 (179); 3 (159); 6 (117); 7 (176); 9 (46); 10 (206); 11 (123); 12 (181); 13 (258); 14 (247); 15 (192); 16 (182); 18 (93); 19 (168); 20 (110); 21 (127); 23 (170); 24 (116); 25 (116); 27 (234); 29 (32); 36 (14)

Schmitt, W., 128 (8); 129 (6); 130 (6); 131 (6); 132 (52); 133 (49)

Snodgrass, R. and Heller, E., 942 (216); 944 (137); 946A (126); 946B (130); 947 (100); 951 (192); 954 (2); 958 (57); 963 (182); 964 (7); 969 (56); 971 (46); 972 (65)

Soto, R., 1 (161); 3852 (176); 3853 (170); 3854 (85); 3855 (116); 3856 (101); 3857 (156); 3859 (167); 3860 (121); 3861 (214); 3862 (235); 3863 (90); 3864 (163); s.n. (9); s.n. (11); s.n. (13); s.n. (15); s.n. (16); s.n. (31); s.n. (33); s.n. (34); s.n. (40); s.n. (48); s.n. (49); s.n. (50); s.n. (52); s.n. (54); s.n. (56); s.n. (62); s.n. (66); s.n. (69); s.n. (75); s.n. (80); s.n. (100); s.n. (102); s.n. (115); s.n. (125); s.n. (126); s.n. (134); s.n. (135); s.n. (144); s.n. (145); s.n. (149); s.n. (156); s.n. (158); s.n. (168); s.n. (171); s.n. (176); s.n. (178); s.n. (179); s.n. (182); s.n. (183); s.n. (186); s.n. (189); s.n. (192); s.n. (207); s.n. (210); s.n. (213); s.n. (217); s.n. (221); s.n. (227); s.n. (232); s.n. (246); s.n. (258)

Stewart, A., 226 (61); 228 (2); 232 (75); 233 (32); 234 (49); 235 (49); 236 (49); 239 (52); 252 (28); 253 (27); 261 (216); 266 (128); 267 (130); 268 (130); 269 (126); 271 (135); 278 (93); 300 (143); 319 (102); 320 (90); 326 (98)

Svenson, H. K., 303 (189); 305 (216); 307 (181); 308 (100); 310 (128); 311 (54); 319 (142); 321 (57); 322 (106); 324 (46); 330 (80); 332 (18); 333 (206); 335 (207); 337 (196); 338 (32); 339 (2); 341 (10); 343 (9); 344 (35); 345 (28); 348 (206); 349 (31); 401 (186); 405 (213); 433 (11); 436 (106); s.n. (46); s.n. (207)

Trusty J. L., 30 (6); 31 (8); 32 (213); 33 (192); 34 (34); 35 (85); 36 (101); 37 (227); 38 (117); 39 (176); 40 (61); 41

(49); 42 (10); 43 (181); 45 (52); 46 (74); 47 (9); 48 (54); 49 (76); 50 (135); 51 (165); 52 (209); 53 (207); 54 (28); 55 (26); 56 (256); 57 (179); 58 (47); 59 (167); 60 (188); 61 (111); 62 (214); 63 (186); 64 (200); 65 (245); 66 (191); 67 (40); 68 (187); 69 (244); 70 (41); 71 (93); 72 (81); 73 (212); 74 (145); 75 (246); 76 (59); 77 (221); 78 (220); 79 (219); 80 (232); 81 (175); 82 (147); 83 (124); 84 (125); 85 (65); 86 (126); 87 (136); 88 (100); 89 (144); 90 (134); 91 (109); 92 (243); 93 (239); 94 (231); 95 (255); 96 (241); 97 (259); 97 (80); 98 (75); 99 (14); 100 (209); 101 (206); 102 (46); 103 (155); 104 (210); 105 (34); 106 (228); 108 (258); 109 (40); 110 (89); 111 (101); 112 (100); 113 (205); 114 (215); 115 (225); 116 (235); 117 (44); 118 (52); 119 (191); 120 (39); 121 (56); 122 (192); 123 (9); 125 (60); 126 (2); 127 (58); 128 (106); 129 (23); 130 (118); 131 (178); 132 (205); 133 (114); 134 (94); 135 (127); 136 (58); 137 (28); 138 (202); 139 (43); 140 (183); 142 (46); 143 (26); 144 (31); 145 (57); 146 (68); 147 (238); 148 (92); 149 (11); 150 (13); 151 (15); 152 (6); 153 (8); 154 (96); 155 (18); 156 (210); 157 (209); 158 (207); 159 (63); 160 (115); 161 (110); 162 (167); 163 (179); 164 (7); 165 (48); 167 (206); 168 (226); 169 (66); 170 (57); 171 (23); 172 (183); 173 (170); 174 (243); 175 (160); 176 (206); 177 (200); 178 (251); 179 (28); 180 (27); 181 (46); 182 (46); 183 (4); 184 (206); 185 (39); 186 (214); 187 (180); 188 (244); 189 (182); 190 (8); 191 (8); 192 (6); 193 (73); 194 (206); 195 (206); 197 (152); 198 (88); 199 (172); 200 (103); 201 (86); 202 (226); 203 (247); 204 (119); 205 (123); 208 (194); 209 (200); 210 (87); 211 (91); 212 (107); 213 (263); 214 (263); 215 (251); 216 (53); 217 (235); 218 (207); 219 (114); 220 (159); 222 (239); 223 (178); 224 (244); 225 (32); 226 (195); 227 (34); 228 (177); 229 (11); 230 (113); 231 (180); 232 (166); 233 (173); 234 (151); 235 (161); 236 (234); 237 (110); 238 (139); 240 (72); 241 (226); 242 (194); 244 (210); 245 (46); 246 (15); 247 (200); 248 (25); 249 (13); 250 (10); 251 (192); 252 (97); 253 (168); 254 (243); 255 (62); 256 (69); 257 (156); 258 (76); 259 (236); 260 (216); 261 (167); 262 (71); 263 (7); 264 (39); 265 (244); 266 (18); 267 (24); 268 (19); 269 (23); 270 (27); 270 (190); 271 (242); 272 (141); 273 (44); 274 (27); 275 (49); 276 (111); 277 (102); 278 (162); 279 (259); 279 (80); 280 (251); 281 (42); 282 (227); 284 (181); 285 (191); 286 (125); 287 (4); 289 (38); 290 (256); 291 (25); 292 (34); 293 (31); 294 (20); 295 (43); 296 (92); 297 (248); 298 (71); 299 (32); 300 (158); 301 (168); 302 (11); 303 (74); 304 (200); 305 (9); 305 (146); 307 (262); 308 (76); 309 (182); 310 (226); 311 (183); 312 (170); 313 (200); 314 (15); 315 (69); 316 (192); 317 (251); 318 (51); 319 (52); 320 (75); 321 (181); 322 (6); 323 (34); 324 (43); 325 (13); 326 (10); 327 (30); 328 (27); 329 (251); 330 (28); 331 (191); 333 (244); 334 (8); 335 (251); 336 (109); 337 (63); 339 (170); 340 (115); 341 (218); 342 (218); 343 (203); 344 (226); 345 (143); 347 (74); 348 (157); 349 (184); 350 (169); 351 (252); 352 (246); 352 (247); 353 (99); 354 (102); 355 (134); 356 (136); 357 (232); 358 (220); 359 (227); 360 (227); 361 (228); 363 (206); 364 (156); 365 (11); 366 (51); 367 (192); 368 (34); 369 (38); 371 (251); 372 (34); 373 (200); 374 (42); 375 (74); 376 (27); 377 (23); 378 (24); 379 (14); 381 (38); 382 (38); 383 (44); 384 (189); 384 (191); 385 (39); 386 (41); 387 (206); 388 (126); 390 (2); 391 (237); 392 (74); 394 (121); 395 (62); 396 (244); 398 (5); 400 (139); 401 (137); 402 (72); 403 (158); 404 (110); 405 (200); 406 (188); 407 (26); 408 (140); 409 (9); 410 (219); 411 (27); 441 (54); 442 (178); 443 (55); 444 (182); 445 (181); 446 (168); 447 (122); 448 (126); 449 (123); 450 (119); 451 (166); 452 (112); 453 (167); 454 (149); 455 (258); 456 (254); 457 (205); 458 (66); 459 (238); 460 (46); 461 (206); 462 (43); 463 (43); 464 (166); 466 (109); 467 (219); 468 (128); 469 (2); 470 (189); 471 (213); 472 (182); 473 (33); 474 (35); 475 (48); 476 (8); 477 (39); 478 (200); 479 (188); 480 (46); 481 (179); 482 (210); 483 (206); 484 (151); 485 (211); 486 (93); 487 (14); 488 (16); 489 (80); 489 (259); 490 (2); 491 (7); 492 (113); 493 (177); 494 (206); 495 (209); 496 (206); 497 (58); 498 (46); 499 (10); 500 (207); 501 (206); 502 (170); 503 (15); 504 (210); 505 (90); 506 (186); 507 (89); 508 (251); 509 (181); 510 (206); 511 (206); 512 (206); 513 (41); 515 (209); 516 (200); 517 (32); 518 (251); 519 (189); 520 (206); 521 (185); 522 (171); 523 (78); 524 (76); 525 (230); 526 (219); 527 (7); 528 (6); 529 (6); 530 (74); 531 (253); 532 (56); 533 (8); 534 (139); 535 (40); 537 (26); 538 (201); 539 (107); 540 (200); 541 (215); 542 (203); 543 (245); 544 (206); 545 (46); 546 (185); 547 (194); 548 (206); 549 (52); 550 (202); 551 (89); 552 (248); 553 (236); 554 (76); 555 (102); 556 (209); 557 (190); 558 (44); 559 (74); 560 (206); 561 (206); 562 (111); 564 (209); 565 (54); 566 (183)

Tucker, G. C., s.n. (137); s.n. (137)

Valerio, J., 1084 (14); 1086 (210); 1093 (117); 1098 (100); 1103 (182); 1104 (181); 1105 (179); 1106 (210); 1108 (206); 1109 (135); 1111 (101); 1592 (46); 2225 (15); 2227 (46); 31048 (46); 31049 (46); 30417 (32); 38490 (75); s.n. (40); s.n. (96); s.n. (214); s.n. (224); s.n. (227)

Copyright © 2006 by the California Academy of Sciences
San Francisco, California, U.S.A.